



and believe that their work will not fail to have due influence on similarly situated companies this side of the border.

#### MR. TESLA ON ROENTGEN RAYS.

LAST week Mr. Tesla gave some of the results of his experiments in the domain of Röntgen rays, before the New York Academy of Sciences, and showed some of his latest types of high frequency generators. Mr. Tesla still adheres to his original view that the Röntgen effects are due to the action of molecules projected from the tube at high velocities, but we must confess our inability to reconcile this view with the results of his experiments in deflecting the Röntgen rays by means of a magnet, unless we assume the molecules charged and at the same time endowed with a vortical motion, a point which Mr. Tesla did not elaborate on. It is so rarely that Mr. Tesla appears on the lecture platform that it is to be regretted that the conditions surrounding his last appearance were not more favorable. It was hardly fair to Mr. Tesla, or to the large audience which had assembled solely to greet him, to delay his appearance until two other estimable speakers had taken up the time of the audience for nearly three-quarters of an hour. The result was that it was close on to 10 o'clock before Mr. Tesla began, and he was forced to conclude his address in its initial stages. It is to be hoped, for the benefit of the science at large that Mr. Tesla will find time to write out his address in full for the Transactions of the Academy. Brief as his utterances were, they were extremely interesting and they evidenced a mellowing and a mastery indicative of higher perfection than ever of his powers as an investigator and elucidator of obscure natural phenomena.

VIEWS OF THE TABLE

Mr. Coul  
Memory  
Posture  
No



### **Tesla Before the New York Companies Section**

A meeting of the New York Companies Section was held in the Engineering Societies Building on Monday, May 15, at 8 P.M., when nearly 600 members of the Section and many ladies were present. The great attraction of the evening was an address by Nikola Tesla, who made his first appearance before the National Electric Light Association with a memorable lecture and demonstration at its annual convention in St. Louis in 1894. The address was practically a review of the researches and inventions of Mr. Tesla since that time, and covered a remarkably large field of work, including wireless telegraphy, wireless transmission of energy, the development of high-frequency apparatus, and the development and perfection of steam turbines, electric pumps and other apparatus. The lecture, which lasted about an hour, was profusely illustrated by lantern slides, and at the close Mr. Tesla showed in operation his highly ingenious new form of pump, operated by the adaptation of some of the new principles described. He was heard with deep attention and frequent applause.

The presiding officer of the evening was Mr. Arthur Williams, and Mr. Tesla was introduced by Mr. T. C. Martin. The chairman gave an account of the entertainment features which will attend the coming annual convention and impressed upon the members the fact that they were practically the hosts on this occasion and would have to assist in extending the hospitalities of the city to all visitors. It was stated that over 1300 members are now in the Section and that 1500 are expected by the time of the convention.

At the close of the more serious part of the evening's exercises, an ex-

cellent vaudeville performance was given and cigars were handed around. It was altogether a most memorable evening in the history of the Section.

### **Activity at San Antonio, Tex.**

There has been considerable activity of late in the Company Section of the San Antonio Gas and Electric Company, and during the past two months several new members have joined. At the last meeting Mr. J. J. Wood, of the Fort Wayne Electric Works, and famous for many inventions in the field of electric light and power, gave an interesting address on developments in the field of aviation. He also described some of his early experiments and experiences with electricity.

### **Prof. Langsdorf Gives an Address in St. Louis**

The regular monthly meeting of the Union Electric Light and Power Company Section, St. Louis, Mo., was held on April 28th before a large gathering of its members. Prof. A. S. Langsdorf, Dean of the Engineering Faculty of the Washington University, delivered an illustrated lecture on the oscillograph, which was followed with the greatest of interest. He discussed the history of the methods used to study the internal action of alternating-current machinery and referred to various instances where the study of the electromotive force and current curves, as given by the oscillograph, assisted in the detection of the causes of trouble with that type of machinery. After tracing the history and development of the various methods of obtaining the curves, he operated and described the oscillograph, which was on exhibition.



## EDISON ELECTRIC INSTITUTE

Clipping From N. Y. Herald Tribune

July 11, 1934

FIL

EDISON EI

## Beam to Kill Army at 200 Miles Tesla's Claim on 78th Birthday

### Death Ray Also Available as Power Agent in Peace Times, Inventor Declares

By Joseph W. Alsop

Dr. Nikola Tesla, inventor of phase electrical current, pioneer of high frequency transmission, predecessor of Marconi with the wireless, celebrated his seventy-eighth birthday yesterday by announcing his invention of a beam of force, somewhat similar to the death ray of scientific romance.

It is capable, he believes, of destroying an army 200 miles away; it can bring down the airplane like a duck on the wing, and can penetrate all but the enormous thicknesses of armor plate. Since it must be generated at stationary power plants by machines which involve four electrical devices of the most revolutionary sort, Dr. Tesla considers it almost wholly a defensive weapon. In peace times, he says, the beam will also be used to transmit immense voltages of power over distances limited only by the curvature of the earth.

In a hour's conversation with the *Verden* correspondent, Dr. Tesla disclosed that he has lately perfected instruments which he believes disprove the present theory of the high physicists that the sun is destined to burn itself out until it is a cold cinder



Herald Tribune photo—Stefen  
Dr. Nikola Tesla

floating in space. Dr. Tesla stated that he is able to show that all the suns in the universe are constantly pulsating in and out, so that the ultimate fate of the universe is explosion.

Dr. Tesla refused to describe specifically his instruments in question on both discovery and even to disclose the principles upon which they are built. He said that at some date soon he expected to make the full details public in scientific journals or before scientific bodies. Since he considers the beam of force a defensive weapon and therefore a pacifist weapon, he hopes to be able to present it at the first time at the conference at Geneva, which he said that minor parts of certain discoveries are still in the blueprint stage, but he insisted that his method of work has almost always been purely experimental.

The aged inventor, a tall, thin, almost spineless man in the sort of brown coat that older men wore before the war, received interviewers in his study rooms in the Hotel New Yorker where he lives. Before the interview, his present work, he reviewed his past achievements, and entitled more than Edison, he said, or any other, to be called the father of the modern age. He had no doubts as to his own age, and not a doubt as to his own power, making clear that he was not a fanatic. He recalled the end of his work together as if to prepare the ground for his announcements.

He came to the idea of a beam of force, he said, because of his belief that no weapon has ever been found that is not as successful offensively as

To

✓ Major

✓ Mr.

✓ Mr.

✓ Mr.

✓ Mr.

✓ Mr.

✓ Mr.

✓ Mr.

✓ Miss

✓ Mr.

RETURN TO

☒☐

Remarks



## LIBRARY

EDISON ELECTRIC INSTITUTE

FILE COPY

L.I.A.

Clipping from

N.Y. Times Jan. 8, 1943

NIKOLA TESLA DIES;  
PROLIFIC INVENTORAlternating Power Current's  
Developer Found Dead in  
Hotel Suite Here

CLAIMED A 'DEATH BEAM'

He Insisted the Invention  
Could Annihilate an Army  
of 1,000,000 at Once

Nikola Tesla, one of the world's greatest electrical inventors and designers, was found dead last night in his suite at the Hotel New Yorker.

Engineers credit him with having devised the first practical application of alternating current; with the invention of the induction motor, and the invention and development of dynamos, transformers, condensers and specialized coils. The principle of the rotary magnetic field embodied in the plants which transmit power from Niagara Falls—in fact the bases of modern hydroelectric power—are credited to Dr. Tesla.

According to the hotel staff, Dr. Tesla, who was 86 years old, had been failing in health for two years. Of vigorous temperament and with emphatic ideas on personal health as well as engineering, he had few visitors, according to the hotel management, which reported that his meals, strictly vegetarian-style, were especially prepared for him by the chef.

"He made everybody keep at a distance greater than three feet," a hotel executive recalled.

A spokesman for the hotel said that Dr. Tesla died as he had spent the last years of his life—alone. He was found dead in bed by a floor maid at 10:45 P. M. She called a house physician, who pronounced him dead.

The New Yorker management was attempting last night to locate friends of the inventor. It was believed he had a nephew living in this city.

Ideas Fantastic Toward End

Nikola Tesla's ideas bordered increasingly on what some considered the fantastic as he advanced in years.

On his seventy-eighth birthday he announced in an interview that he had invented a "death beam" powerful enough to destroy 10,000 airplanes at a distance of 250 miles and annihilate an army of 1,000,000 soldiers instantaneously.

On his eighty-fourth birthday he declared he stood ready to divulge the secret of his "death beam" to the United States Government that, he said, would build an invulnerable Chinese Wall of defense around the country against any attempted attack by an enemy air force, no matter how large.

"All my inventions," Dr. Tesla said, "are at the service of the United States Government."

The "death beam," he added, is "based on an entirely new principle of physics that no one has ever dreamed about." It would be only one one-hundred-millionth of a square centimeter in diameter, he said, and could be generated from a special plant that would cost no more than \$2,000,000 and would take only three months to construct.

## A Defense Against Invasion

A dozen such plants, located at strategic positions along the coast, Dr. Tesla said, would be enough to defend the country against all possible aerial attack. The beam would melt any engine, whether Diesel or gasoline-driven, and would also ignite the explosives aboard. No possible defense against it could be devised, as it would be all-penetrating, he declared.

Should the government decide to take up his offer, Dr. Tesla stated, he would go to work at once and keep on working "until I collapsed." However, he added, "I would have to insist on one condition—I would not suffer interference from any experts. They would have to trust me."

The beam, he said, involved four new inventions. One consisted of a method and apparatus for producing rays and other manifestations of energy in free air, eliminating the necessity for a high vacuum; a second was a method and process for producing "very great electrical force"; the third was a method for amplifying this force, and the fourth, a new method for producing "a tremendous electrical repelling force." This would be the projector, or gun, of the system. The voltages for propelling the "death-beam" to its objective, Dr. Tesla said, would attain a potential of 50,000,000 volts.

Dr. Tesla said he was convinced "that the battleship was doomed" and that "what happened to the armored knight will also happen to the armored vessel." For this reason, he believed that money spent on battleships would be wasted, and such funds "should be directed in channels that will improve the welfare of the country."

Since he made his first practical invention—a telephone repeater—in 1881, while living in Budapest, Dr. Tesla claimed to have made about 700. Many of them were of great importance, but these were nearly all invented in the last twenty years of the past century.

## Not Practical as Business

He was greatly handicapped by lack of funds, for he was anything but a practical man as far as business was concerned. It was said that he was frequently victimized, but he did not seem to worry much as long as he had a place to work.

Tesla probably could have become a rich man had he chosen to become an employee of a large industrial concern, but he preferred poverty and freedom. Early in 1887 he had formed the Tesla Electric Company of New York, but the concern was not a financial success. For many years he did not even have a laboratory to work in, conducting his experiments in hotel rooms.

Of his inventions the most important were his systems of alternating current power transmission and distribution of electrical energy. His system of electrical conversion and distribution by oscillatory discharges was highly significant, as were his researches and discoveries in radiations, material streams and emanations.

After his discovery of a system of transmission of power without wires and of high-potential magnifying transformers, Tesla had been closely engaged since 1890 in the development of a system of telegraphy and telephony, and designing a plant for the transmission of power without wires, to be erected at Niagara.

As early as 1908 Tesla made it known that he was experimenting with interplanetary communication. He firmly believed that most of the planets are inhabited and that messages could be sent between the earth and Mars, Jupiter and Venus.

He also had visions of harnessing the sun's rays and of utilizing the energy of the sea.

## Son of Greek Clergyman

Nikola Tesla was born at Smiljan, Lika, a border country of Austria-Hungary, on July 10, 1856. His father was a Greek clergyman and orator, and his mother, Georgina Mandic, was an inventor.

His education began with one year in elementary school and then four years of the lower Realschule at Gospić, Lika. Then he went to a higher school at Carlsstadt, Croatia, being graduated in 1873. He studied for four years at the Polytechnic School at Graz, devoting most of his time to mathematics, physics and mechanics, and then had two years at the University of Prague, where he studied philosophy.

In 1881 he went to Paris, where he worked as an electrical engineer, and the following year he went to Strassbourg, where he installed a mechanical plant. He was attracted to America by the remarkable progress in electrical energy, and came to this country in 1884.

For some time he worked with Thomas A. Edison at West Orange, N. J., chiefly designing motors and generators. In a short while a proposal was made to him to start his own company. He accepted the terms and began by working up a

Bennion

Campbell

Coleman

Greenwood

Herbert

Kellogg

Kent

Maxwell

Morgan

Rainey

Woods

RETURN TO LIBRARY

Remarks:



defensively. The perfect weapon of defense, he felt, would be a frontier wall, impenetrable and extending up to the limits of the atmosphere of the earth.

#### Creates Rays in Free Air

Such a wall, he believes, is provided by his beam of force. It is produced by a combination of four electrical methods or apparatuses. First and most important is a mechanism for producing rays and other energy manifestations in free air. Hitherto vacuum tubes have always been necessary. Second is an apparatus for producing unheard-of quantities of electrical current and for controlling it when produced. The current is necessary as out this, no ray of sufficient strength could be produced. The third is a method of amplifying and amplifying the current process, and the fourth is a method of producing "tremendous electrical repellent force."

"These four inventions in combination enable man to loose in free air remarkable military," Dr. Tesla remarked. "By scientific application we can project destructive energy in thread-like beams as far as a telescope can discern an object. The range of the beams is only limited by the curvature of the earth. Should you launch an attack in an area covered by these beams; should you, say, send in 10,000 planes or an army of a million, the planes would be brought down instantly and the army destroyed."

"The plane is thus absolutely eliminated as a weapon; it is confined to commerce. And a country's whole frontier can be protected by one of the plants producing these beams every 200 miles. Nor should they be much more costly than an ordinary power plant."

#### It Is an Electric Gun

The beam of force itself, as Dr. Tesla described it, is a concentrated current—it need be no thicker than a pencil of microscopic particles moving at several hundred times the speed of artillery projectiles. The machine into which Dr. Tesla combines his four devices is, in reality, a sort of electrical gun.

He illustrated the sort of thing that the particles will be by recalling an incident that occurred often enough when he was experimenting with a cathode tube. Then, sometimes, a particle larger than an electron, but still very tiny, would break off from the cathode, pass out of the tube and hit him. He said that he could feel a sharp stinging pain where it entered his body, and again at the place where it passed out. The particles in the beam of force, ammunition which the operators of the generating machine will have to supply, will travel far faster than such particles as broke off from the cathode, and they will travel in concentrations, he said.

As Dr. Tesla explained it, the tremendous speed of the particles will give them their destruction-dealing qualities. All but the thickest armored surfaces confronting them would be melted through in an instant by the heat generated in the concussion.

#### Some Parts Still Unmade

Such beams or rays of particles now known to science are composed always of fragments of atoms, whereas, according to Dr. Tesla, his would be of microscopic dust of a suitable sort. The chief differentiation between his and the present rays would appear to be, however, that his are produced in free air instead of in a vacuum tube. The vacuum tube rays have been projected out into the air, but there they travel only a few inches, and they are capable only of causing burns or slight disintegration of objects which they strike.

Dr. Tesla declared that the two most important of the four devices involved in his force beam generator, the mechanism for producing rays in free air and the mechanism for producing great quantities of electrical current, had both been constructed. The two intensifying and amplifying apparatuses are not yet in working order, but he said that the most perfect construction of them they are, they will work as he intended them to do.

"These are the things," he said, "are of the kind that can be calculated with the most positive accuracy. Like many other things I have done they require no previous experiments, since they are properly conceived. There are a few details to be finished—my calculations might be perhaps 10 per cent off at present—and then the whole thing will be presented to the world. It has always been my practice to give the world a sort of preview of what I am doing so that a reception is prepared."

"I should also say, and this is perhaps as important as anything else about it, that in this apparatus all limitations as to electric force and have been removed."

It was evident that Dr. Tesla's work on the force beam as a peace-time means of power transmission was far less advanced than his work on it as a defensive weapon. He did not describe the nature of the receiver which will transform the force beam into useful power, though he declared that he had designed one. Nor was he able to show just how the dangers of having such death-dealing but invisible beams traveling through the air could be surmounted.

Dr. Tesla was far less definite in his description of the experiments which led to his revolutionary prediction of the future of the sun and its system than he was when talking of the force beam. He had, he said, detected "certain motions in the medium that fills space, and measured the effects of these motions." The results of the experiments had led him "indefinitely" to the conclusion that such bodies as the sun are taking on mass much more rapidly than they are dissipating it by the dissipation of energy as heat and light.

#### "Heat to Kill the Peoples"

He pointed out that this means a future for the earth is different from the general belief of the future of the sun. It is generally held that life on the earth will flourish when the sun grows so cold that its temperature drops to a point where life can no longer be supported. Dr. Tesla prophesies that life on the earth will cease because the planet will grow too warm to support life, and he believed that life will begin on outer planets now too cold. He said that his discovery not only allowed him to predict a very different future for the heavenly bodies from that now generally expected for them, but also to calculate in a new way their age.

Nor were these two discoveries, of a force beam and a new future for the universe, the only new things Dr. Tesla had to offer. The completely new and unlimited source of energy which he stated he was at work on is, he said, still under examination by him. Since he first spoke of it, great strides have been made, and the complete announcement of it is to be expected in a comparatively short time.

Finally there was the electric bath. The idea of a bath of electricity to cleanse the person far more completely than water ever could has always been at the back of Dr. Tesla's mind. Many years ago he built a machine which performed the function successfully, but, because it cost too much and was not without its dangers, he dropped it as impractical. Lately he has improved it so much that he feels it is now fit for general use.

#### Works Twenty Hours Daily

"You may think this is a lot of work for an old man like me to have on his hands," he said with a little smile. "You may think I have too many big things—I have told you three—on my hands. But I have worked for sixty years now, and I have worked twenty hours a day. I have such a store of ideas that I can see clearly. I have concentrated on my subject. My brain works better now than it ever did when I was a young man. I am capable of far more than I was in what they call 'your prime.'"

He smiled again. The white, parchment-like skin, drawn tight over a finely built bony structure, creased round his eyes and mouth. He admitted to being a little thinner than last year, but, he explained, every one dries up as time goes on, and there is nothing in being thin that can interfere with work.

He was asked a question about birthday celebrations and congratulations. He had received congratulations from all over the world, he said, but the one which pleased him most was from his sister in Yugoslavia, Mrs. Marica Kosanovic, who is three years younger than he and "the smartest in all our family." He talked for a while of his family, recalling all the inventors there were—five recorded—and students in his ancestry.

"As for celebration," he added, "my only celebration is a little work, and these small disclosures of results."



practical system of arc lighting, as well as a potential method of dynamo regulation, which became known as the "third-brush" regulation."

#### Invented Coil in 1891

He also devised a thermodynamic motor and other kindred devices. Soon after the Tesla Electric Company had been formed Dr. Tesla produced his epoch-making motors for alternating current, in which, going back to earlier ideas, he evolved machines having neither commutator nor brushes. This important invention came in 1888. His system of electrical conversion and distribution by oscillatory discharges was devised the following year, and in 1891 the now famous Tesla coil, or transformer, was invented.

Dr. Tesla devised a system of wireless transmission of intelligence in 1893, and this was followed by mechanical oscillators and generators of electrical oscillations.

From 1896 to 1898 Tesla made researches and discoveries in radiations, material streams and emanations.

Dr. Tesla received the Elliott Cresson gold medal in 1893 in recognition of his original work first presented before the Franklin Institute and the National Electric Light Association.

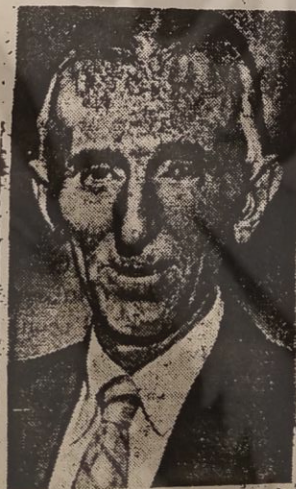
In November, 1931, he published designs of two power plants, one to utilize the heat below the surface of the earth, the other to take advantage of the difference between the upper and lower levels of the ocean.

#### Preferred Shop to Society

Shy of business and ascetic in his tastes, Dr. Tesla preferred his workshop to society. He was not married. He ate sparingly and drank neither coffee nor tea because he considered those beverages to be highly injurious. On the other hand, he regarded alcohol in moderation as virtually an elixir of life.

At one time Tesla had the financial backing of the late J. Pierpont Morgan. He built a tall steel tower on Long Island to send out wireless power, but when his backer died no more money was forthcoming and the plan had to be abandoned.

Dr. Tesla once owned a laboratory on Houston Street, New York, but it burned down and he never had another.



NIKOLA TESLA

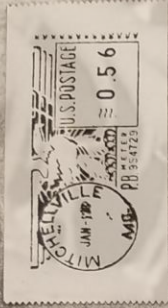


WILLIAM M. KOLB  
34 Loughton Street  
Upper Marlboro, Maryland 20772

Lee,

4 Jan 88

I chased down the NELA Minutes. They were published in a small monthly journal that contained only a mention of the Tesla presentation (copy enclosed). No other mention exists in the records -- unfortunately. While there, I did find some newspaper clippings in a folder they had on Tesla. Thought you might be interested. Happy New Year. Bill K.



LEE ANDERSON  
2525 So MEADE ST.  
DENVER, CO 80219

Box 7  
Caldera

Anderson, Lee - Tesla addresses and features - NATIONAL ELECTRIC VEHICLE ASSOCIATION, New York Companies  
Section - May 13, 1911  
MS 481



## NEW INVENTIONS BY TESLA

ADDRESS AT MEETING OF NEW YORK SECTION  
OF NATIONAL ELECTRIC LIGHT  
ASSOCIATION.

The meeting of the New York sec.

deal of trouble. Some went so far as to assert that he had never invented anything.

Mr. Tesla alluded to the discoveries of Hertz which startled the world. He had tried to repeat the Hertz experiments, worked on them for two or

chemical analog, and showed in slides experiments made in 1899 in which incandescent lamps were lighted in this manner. He then exhibited other diagrams of his wireless system and produced a slide showing a lamp lighted by wireless energy. The lamp he de-

other more numerous saving of four kilowatts was indicated by the use of two small motors with a combined rating of eight horsepower instead of an existing motor of twenty-horsepower rating.

## THE NEW INVENTIONS OF TESLA.

The address made by Dr. Nikola Tesla before the New York Section of the National Electric Light Association this week, and reported upon other pages of this issue, is one which will attract great attention on account of the startling statements which were made by the speaker. Mr. Tesla has been working upon the inventions now announced for a number of years, and while it is impossible to estimate their importance until further details are made known, the claims made for transmitting energy and speech to great distances point to an epoch-making discovery.

The experiments made by Dr. Tesla upon high-frequency and high-potential currents about twenty years ago were most illuminating and opened a field of vast possibilities to both the scientist and the engineer—a field which is still being explored. His other discoveries have attracted considerable attention, and this latest announcement bids fair to prove the most important of all.

Aside from his work on electrical oscillations, Dr. Tesla has invented and constructed a prime mover for which remarkable results are claimed. This engine is said to deliver ten horsepower for each pound of weight, a ratio which will mean revolution in the fields of the automobile and the flying machine.

The scientific and technical world will eagerly await the further demonstration of all these possibilities, for their practical realization will mean a most important step forward in electrical and mechanical engineering.

## DESIGNING HYDROELECTRIC PLANTS FOR ECONOMIC SERVICE.

The uncertainties which surround many hydroelectric undertakings in comparison with the cut-and-dried development common to steam-plant practice are at once an inspiration and a curse to the designing engineer. Much that is picturesque and encouraging to the electrical industry is associated with the production and transmission of power from water falls, and for this reason even commonplace developments of streams are full of interest and suggestion. Under modern methods of engineering design and supervision, however, two fundamental objects may be seen in the exploitation of water power by responsible interests—the reduction of the investment to the lowest possible terms consistent with reliable service, and the establishment of a plant which shall be capable of operation for long periods with a highly efficient use of water and by a force of employees almost ridiculously small in comparison with the number of men needed in a steam plant of the same capacity.

Examination of hydroelectric plants of recent construction shows that economical operation is receiving much more

MS 481

Section - May 15, 1911

Box 1  
Cable 2



## NEW INVENTIONS BY TESLA

ADDRESS AT MEETING OF NEW YORK SECTION OF NATIONAL ELECTRIC LIGHT ASSOCIATION.

The meeting of the New York section of the National Electric Light Association was held at the Engineering Societies Building, New York City, on Monday evening, May 15, 1911. Chairman Williams presided. The report of Mr. Thomas, chairman of the Membership Committee, showed that the present membership of the section is approximately 1,800 and it is the aim of the committee to have the membership at least 1,500 by the time of the annual convention of the association, beginning May 29. Chairman Williams then outlined the entertainment to be tendered by the Greater New York lighting companies on the occasion of the convention.

T. C. Martin then introduced Nikola Tesla, preceding the introduction by a statement that the membership of the N. E. L. A. on May 15 was over 8,100, a growth of over 5,000 in eighteen months. Mr. Martin referred to the occasion when Mr. Tesla gave a demonstration of his earlier inventions at the time of the St. Louis Convention in 1893.

Mr. Tesla said that some time ago he experienced the necessity of testing an invention he had perfected under conditions existing in a modern plant and he approached the officers of the New York Edison Company for facilities and received most cordial co-operation, for which he was greatly indebted. He introduced the subject by saying that the gift of invention and discovery is a great one, and that there is no enjoyment that he could picture in his mind so exquisite as the triumph which follows an original invention or discovery. But the world is not always ready to accept the dictum of the inventor, and doubters are plentiful, so that discoverers have often to swallow bitter pills, and he had received an ample share of bitterness as well as pleasure.

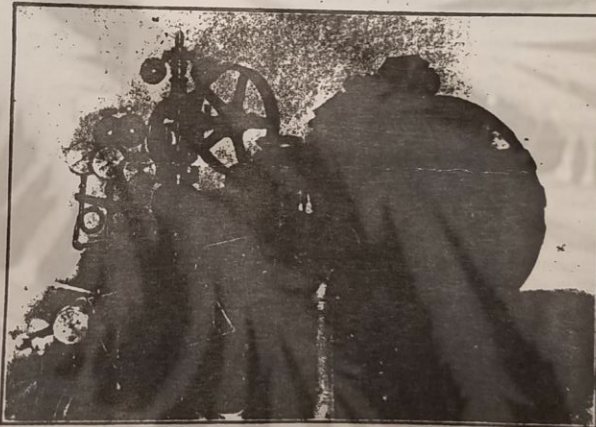
He then referred to the fact that in 1887 or 1888 he had brought out the rotating magnetic field. It was at a time when the world was not yet prepared to receive the idea and he had to stand many attacks, and when his patents were fought he had a great

deal of trouble. Some went so far as to assert that he had never invented anything.

Mr. Tesla alluded to the discoveries of Hertz which startled the world. He had tried to repeat the Hertz experiments, worked on them for two or three years and had to give them up. He called on Hertz and told him of his doubts. Since that time he has satisfied himself that Hertz had seen true.

He mentioned the discovery by Roentgen in 1895. He had investigated the wonderful phenomenon which Roentgen investigated, and after long search finally ascertained the true nature of the rays and published the results in a series of papers in the *ELECTRICAL REVIEW*, declaring we had to deal with a new matter which was never before studied, showing that the particles projected were smaller than atoms, that they were of various sizes,

mechanical analog, and showed in slides experiments made in 1899 in which incandescent lamps were lighted in this manner. He then exhibited other diagrams of his wireless system and produced a slide showing a lamp lighted by wireless energy. The lamp he declared could have been lighted if it had been placed at the antipodes. Dwelling on his wireless system in detail he said that it comprised five distinct inventions. The first of these was his transformer. To convey an idea of the wonderful effects which can be produced with that instrument a slide was produced illustrating an experiment performed very frequently in the years of 1892-96. Behind a screen was placed the primary of such a transformer and before the screen a bulb of about fourteen inches in diameter and containing a drop of mercury. The experimenter holds the bulb in the



TESLA TURBINE COUPLED TO FIFTY-KILOWATT WESTINGHOUSE GENERATOR

that they carried electrical charges and moved with great velocities.

Mr. Tesla further said that in dealing with electrical matters, there is one branch to which he had devoted a large portion of his life, and it is proper he should speak on that subject. He referred to the wireless transmission of energy. The problem presented itself to him as follows: If we can transmit energy through a closed circuit, we should also be able to transmit it through a single wire, and return being effected through the medium.

He exhibited diagrams illustrating the electrical scheme, as well as a me-

air and the induction from the primary is so strong that it evaporates the mercury and produces an extremely powerful light.

He next described his "magnifying transmitter" and showed several striking experiments with the same on the screen. One slide showed the transmitter used by him in Colorado on an immensely large scale. Streamers were visible extending from the center of the coil and measuring fully forty feet, the width of the same being sixty-five feet. The discharge is so powerful that it goes through the open roof, being carried up by the heat produced.

MS 481

Address, Leonard - Tesla addresses and lectures

Address, Leonard - Tesla addresses and lectures - National Electric Light Association, New York Companies Section - May 15, 1911

Box 7



He next showed another effect of such a magnifying transmitter with a large ball, thirty-nine inches in diameter, which was placed just a little above the building, the roof of which was removable. Several of these streamers could be followed a hundred feet into the air; from a distance it looked as if the building was on fire and the roar could be heard for ten miles. He remarked that this was one of the most difficult experiments because of the great force it takes to reach the required density.

Mr. Tesla then referred to his third invention called the "art of individualization in which the nervous system of the human body was imitated in a crude way" (indicating diagram).

"I will not bother you with theories

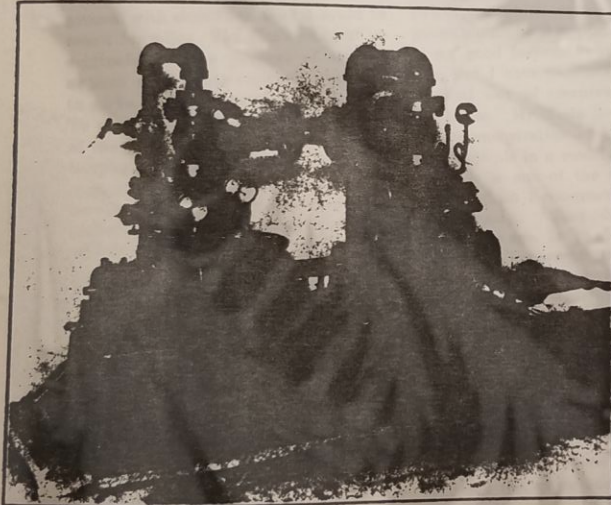
with, are because the workers in that field are laboring under delusions—they are transmitting messages by Hertz waves, and in this way no secrecy is possible."

He then showed a picture of a machine exhibited in 1898, to which he first applied this art of individualization.

After stating that his fourth invention pertaining to the system was a peculiar receiver condensing the energy, he dwelt on his discovery of the stationary waves which was the last and most important. Before he could transmit energy without wire economically he found it absolutely necessary to learn how this great body, the planet, behaved, how the current would pass through the same and what are its con-

inches in diameter placed on the top.

Mr. Tesla then said: "I had not been in Colorado Springs but a few months when I made the most marvelous discovery I ever expect to make in my life. Before explaining it to you, let me say that I was not stirred at all by its practical value, though it was immense, but by its philosophical significance. You know that through ages past, man has always attempted to project in some way or other energy into space, but in all his attempts, no matter what agent he employed, he was hampered by the inexorable law of nature which says that every effect diminishes with the distance, generally as the square of the distance, and sometimes more rapidly. Now, the discovery I have made upset all that has gone before, for there was a means of projecting energy into space, absolutely without loss from any point of the globe to another, to the antipodes if desired. In fact, a force impressed at one point could be made to increase with the distance. I saw at once that distance was annihilated in all the three aspects; in the transmission of intelligence, in the transport of our bodies and materials, and in the transmission of the energies necessary for our existence. You can imagine how profoundly I was affected by this revelation. Technically, it meant that the earth, as a whole, had a certain period of vibration, and that by impressing electrical vibrations of the same period upon it, it could be thrown into oscillation of such nature that innumerable benefits could be derived from it. Let me tell you of but one application of the principle. Vessels could be equipped with simple devices enabling them to sail across the Pacific along the shortest routes and the captain of each vessel could tell the distance, from a point of reference, within a few feet. We do not today know the exact diameter of the globe. Astronomers have been unable to determine it within a thousand feet. By this discovery without any kind of surveying instrument or even without going out of the room, an electrician can determine the diameter of the globe within four feet. Thousands of such problems, which are of immense practical importance, can be solved and I have often thought that annihilation of distance is the only means of bringing about a quick understanding and universal peace between nations. It will remain for the



TWO TESLA TURBINES, OF 200-HORSEPOWER EACH, COUPLED TOGETHER BY TORSION SPRING.

and details," he said, "but can assure you that as long as the world exists, if all men were Faradays, they could never invent a scheme which would permit as accurate a transmission of messages or quantities of energy to a distance through a wire as has been found practicable without wire by this method; for in a wire transmission the secrecy is only the result of isolation in space, while in the wireless we get the benefit of combinations which are not practicable in a transmission through artificial channels. All the statements you read in the newspapers that wireless messages are interfered

stants, capacity, self-induction and resistance. As he could not find opportunity in the city for investigating he went to Colorado Springs and erected a laboratory for the purpose. Several views of the same were projected on the screen. One showed in the center of the building a coil fifty-one feet in diameter and many smaller ones within, which had been attuned to respond to higher harmonics.

Another effect of the magnifying transmitter was next illustrated, showing a display with powerful streamers shooting out in all directions from a coil, as well as a ball of thirty-nine

d to  
res.  
the  
in  
three



future to decide whether I have seen truly or not.

"On my return from Colorado I completed plans to demonstrate these principles on a larger and commercial scale, my laboratory in Colorado being only constructed for purposes of scientific demonstration. Here are some views of my plant on Long Island, erected in 1901. This plant is nothing but what I have called a magnified transmitter which, when completed, will enable you to pick up any telephone and, without the slightest change in the stations, talk as clearly as though sitting on the other side of the table to any subscriber in the world. It will make no difference where he is located, and if desired the voice may be made to come out of the ground with such force that it could be heard for miles. The plant was put up originally for the purpose of serving as such a telephone exchange, but was to serve also for other important uses. To give you an idea of the magnitude of the effects, when you speak into the telephone there will be electrical energy at the rate of one billion horsepower sending your voice across the globe, and not only this, but the plant will be so organized that hundreds of people can talk at the same time to any part of the world without the slightest interference. Of course, you will have to take my word for it now, but I hope that I shall live to realize what I have begun. I will carry out my plans exactly as they were first made."

"My project was evidently far in advance of the times. Its progress was retarded and I was compelled to devote myself for a time to other inventions which appealed more to practical men. After years of careful thinking, I found that what the world needed most, and would most readily accept, was an efficient prime mover, a converter of heat into mechanical energy. This all the more as a new world is about to be explored, the world of waste. When you consider that in the manufacture of steel and iron in this country, some thirty million horsepower could be harnessed and a proportionate income derived from that power, all of which is wasted today, you can see what value a good converter of thermal energy into mechanical energy would have."

"But to conceive that a prime mover is valuable and to get up one, are two different things. After some thought I

finally came to the following argument: suppose a number of plates are moved through a fluid medium, the medium will, of course, be dragged along with the plates, and a certain frictional loss will be incurred. Inside the casing are arranged on a shaft a number of disks with openings and spokes and there are orifices of entrance on the sides to produce a perfect balance, and the usual arrangement of outlets. This system of disks being rotated, the water or air is sucked into the channel, is taken hold of and moves in a logarithmic spiral with very nearly the velocity of the system. It was perfectly well known that a fluid would be dragged by rotating surfaces, but somehow nobody realized the conditions for economic working, nor has any one properly grasped the principles which could be applied to propulsion. So it happens again that it is my good fortune to come to the rescue, and I have produced a highly economical way of compressing or pumping fluids." Mr. Tesla then gave a practical demonstration of the working of the principle in a model pump.

"This is one of the early forms of blower which I constructed" (referring to diagram). "That was constructed three years ago. It is a two-stage blower. Far more important than the pump blower or compressor is the turbine. Here is a simple structure, a casing with two entrances, disks arranged on the shaft and outlets in the center for the escape. In this instance the power is applied to one of the openings and the fluid moves with decreasing velocity toward the center until its energy is exhausted and transferred to the shaft. If the theory is correct, I am able to take out the entire energy of steam in one single stage. In the present turbine, sixty-five per cent is the limit of efficiency; theoretically I should be able to get ninety-nine per cent of the total energy of the steam on the shaft in these turbines. These turbines are simple, they have a great torque, far better than other turbines, and a machine will develop ten horsepower for every pound of weight. This principle can also be applied to the gas turbine."

Several slides showing two turbines coupled together were then projected on the screen and a new method of power measurement described. Mr. Tesla then dwelt on the advantages of these machines and showed a number which were constructed and in operation. They have no ducts, nozzles or

such complications which cause so much trouble, and besides the machines are perfectly reversible, working with the same efficiency back or forth, making a valuable machine for driving boats, locomotives, automobiles, etc. The accompanying illustrations show two of these turbines.

"In this new invention we have a beautiful solution of many mechanical problems. We have a prime mover which is reversible, ideally simple, of enormous torque, incomparably greater than the turbine possesses, so I am looking for a revolution in mechanics from the application of this principle."

Owing to the lateness of the hour, the other papers which were to have been presented at the meeting were laid over until the next meeting. The members of the Section and their guests were then entertained by an interesting vaudeville performance.

#### Gas-Engine Plant in Japan.

The Japanese Government has placed an order for the complete equipment of an electric power station for supplying electric railways. Mond gas producers will be installed in three units, each unit consisting of three generators and a sulphate-of-ammonia recovery plant. The fuel to be used is of an inferior quality, containing nearly twenty per cent of ash. Most of the steam for the gas plant will be obtained from boilers heated by means of the exhaust from the engines. There will be four Nürnberg gas engines of the double-acting four-cycle type, each of 2,400 brake horsepower, with the cylinders arranged in tandem. The bed-frames will weigh fifty tons, and the crankshaft twenty tons. The alternators will be direct-connected to the engines, and run in parallel, the frequency being twenty-five cycles. The section of railway to be electrified is that between Tokyo and Yokohama. The power station will be situated near Yokohama, and there will be two substations, with probably three later on. The erection is to be completed, and the plant put into commercial service, within two years.

#### A Long Telephone Cable.

The British Postoffice has decided to build a cable from Holyhead to Ireland, 56 miles long. This will be the longest submarine telephone cable in the world. One cable containing three pairs of wires will be used.

MS 481

National Electric Light Association, New York Companies

Box 7



2525 South Meade Street  
Denver, Colorado 80219  
July 2, 1987

Edison Electric Institute Library  
1111 19th Street, N.W. 8th Floor  
Washington, D.C. 20036

Attention: Ms. Ethel Tiberg,  
Mgr., Library Services  
Gentlemen:

I am looking for an item possibly in the archives of the National Electric Light Association, which organization I believe was absorbed by the Institute at some time in the past.\* Specifically, I wish to obtain a copy of the minutes for its meeting of May 15, 1911, New York City, which minutes may include the text of invited speaker Nikola Tesla.

If the archives of NELA are with the Institute, please advise me of the prospect (incl. costs) of furnishing a copy of the item. If EEI did not retain these archives, I would appreciate your advising me of their disposition.

In the event you may wish to discuss this request by phone, I can be reached at the number on the enclosed card.

Sincerely,

*Leland Anderson*  
Leland Anderson

\* It would be helpful if you could provide a brief history (pamphlet?) of EEI which cites the acquisition of NELA.

Mr Anderson

- 7/14/87
- ① The NELA Proceedings for 1911 are dated May 30. A presentation by Nikola Tesla was not found
  - ② The article attached from Electrical World, 1/14/33, p. 49, notes the dissolution of NELA and the formation of EEI.
- Ethel Tiberg

MS 481

National Electric Light Association, New York Companies  
Section - May 15, 1911

Box 7  
Culver



ADDRESS BY NIKOLA TESLA  
Before the New York Electrical Society  
November 29, 1893

2,804 words  
of text



The Chairman (C.E. Mailoux): We pass on to a name which is magic in this country and over the world, the name of a man who is one of the greatest explorers and discoverers of the present century, Mr. Nikola Tesla. A man who, perhaps, has gone farther toward the border line of discovery in analytical and technical physics, the vibrations of matter and the minute analysis of those processes that neither the microscope nor the crucible can reach and which only the mind of the trained and careful student, possessing qualities as are scarcely allotted to more than one man in a century, like Mr. Tesla, can deal with.

Mr. Tesla: I have with great reluctance accepted these compliments, because I had no right to interrupt the flow of speech of our chairman. You may, perhaps know -- at least those of you who have followed the electrical development more closely -- that the subject about which I am to say something is one which I recently presented before the Electrical Congress. During the past two years or so I have been gathering results and preparing work which I had in mind to present before the annual meeting of the American Institute as one of its members. But, as the date grew near, I found that the problems became so complicated and difficult that I could not do justice to the subject in the limited time, and so I made up my mind to drop the work for a little while, and go to the Exhibition and learn what I could, as any reasonable man would do. But the pressure at that time exerted upon me was so great that I could not resist when a number of scientific men urged me on to do something -- deliver a lecture.



A great many promised that they would come, but at the last moment they became ill, and when the programme was sifted down I was the only healthy man who had the time to deliver a lecture; and so I managed to take some of my apparatus and, through the courtesy of some officials of the American Express Company, especially Mr. Sherman, to whom I am indebted, was able to arrive in time, pretty nearly losing my opportunity by the impoliteness of one of the officials of the Fair; and so I gave a brief outline of this work.

Now, as a matter of fact, at that time I had gone considerably into the study of the practical aspects of the work which I was to present, and my notion was that I was touching upon something very important, something which would lead perhaps -- so I thought in my enthusiasm -- something which would lay the foundations of a novel industry, perhaps of more than one industry. But to speak in that strain before such a gathering as I had the honor to address there would have required a nerve which I did not possess, or, if I did possess it, it would be sure to leave me when I wanted to use it; and so I dwelt chiefly on those features which possessed a purely scientific interest, my desire being to present the subject very modestly, as I was not quite sure of some of the questions involved. Right after the lecture I asked one of my friends what he thought of it. He said it was well enough, but it could have been better. A prominent engineer came to me and said: "Mr. Tesla, I want to tell you something, but I fear it may offend you." I know what was coming and so I asked what it was. He said: "Well, don't you work on steam engines? You have done some work in electricity. If you stick to it you will do some good



work, but if you work on steam engines you are bound to fail." All these men that I mention are the most prominent in the profession. Another said: "I wonder what Tesla is going to do with his blessed engine." Another, to whom I showed the advantage of doing away with complicated mechanism and generating electricity directly, said, after he had watched it for a long time, "Couldn't you apply this to rotating motion?" Now, this is the way that my work was received! But I was quite prepared for that because for fully two years I had had these ideas in my mind. I rejected them and rejected them again and again, until I got in my mind the construction of the apparatus, until I overcame some difficulties which at first seemed to me insuperable, and, finally, I devoted myself to this work. One of the first impulses which guided me was to produce an absolutely constant motion, which would be independent of any friction losses, or gravity or temperature changes within very minute limits. Now, you can employ a pendulum, you can employ clock-work of a vibrating spring, or some such device as that, but they are very unstable. I wanted to produce a positive motion, so that I might operate what I called some time ago a disruptive discharge coil. I may assume that some of you know that some time ago I advanced a method of producing currents of high frequency from direct or alternating currents. The method consists of charging condensers, discharging them either through a primary and then introduce devices in coils of the secondary or in its own current of high potential. Now the lamp to be operated with such coils is perfect enough. But the devices themselves are inefficient in the production of these currents, and one reason



was that these devices did not yield a perfectly constant vibration. I had to depend on a disruptive gap. I used air blasts, or oil streams, or a mechanical interrupter. Now with this device which I invented subsequently I was able to maintain a vibration with perfect constancy. This device consisted of a spring which required several tons of force to spring a certain distance, and which was constantly kept in vibration by steam pressure or air pressure. In the beginning I used springs of tempered steel. These steel springs would break, though they had a section of two or three square inches. So I resorted to air springs. The air springs would not break, but they had no constant resilience. Then I made I made the chambers of the air springs communicate with the outer air. Then I maintained boiling water around the jacket. Now you know this device yields a constant vibration, and as the force which is driving it is many tons and the friction but a very small matter, it is unaffected by the pressure, and so I have a constant vibration. This was one of the chief features I wanted to present, and is the device which I believe will be used for many purposes, for instance, governing all sorts of mechanisms, engines, and so on. This was one of the features which had interest for scientific men, because with this I am now enabled to produce currents of perfectly constant frequency. But this was merely the tail of the work which I have been doing. You have seen a few designs of engines described by the eminent speaker, who is one of the most competent to speak on the subject, and who has shown us a great many complicated mechanisms. They are exactly adapted to illustrating what I have to say, and I would ask



whether it is not worth while I attempt to simplify those mechanisms which we have been using heretofore for the production of electric currents. When we look at a steam engine and inquire where the power comes from that drives the steam engine, we will always find that the power comes from a little box -- a cylinder with a piston in it -- and all the other appurtenances are really but to keep it going. You may do away with the flywheel, with the cross-heads, with the eccentrics, with all the appliances, provided that you can in some other simple way govern the motion of the mechanism. So then my first idea was to apply the motion of the piston, which is freely movable, to a magnetic field, to move a magnet or a coil in a magnetic field and so generate currents by this direct motion. Now let us see what we can do in that respect. First, we reduce the weight of the engine for the same pressure and the same piston speed to  $1/30$  or  $1/40$  if not  $1/50$  of its weight. Furthermore, we do away with all mechanical frictions. The engine designed according to my ideas has a mechanical efficiency of  $99\frac{3}{4}$  per cent. Now that is in itself a very big item and renders it worth while endeavoring to make this mechanism a commercial success. But there are other far greater things. You will find that engineers often say what an advantage it is to apply the direct motion of the steam piston to a pump. In reality the advantage in a pump is but a very minute one. The water column has got an enormous inertia, and what we do gain in the direct-acting pump is a merely a matter of overcoming some additional frictions which we have in the ordinary engine. We may take the mechanical efficiency -- I gather the data from various



works -- we may take the efficiency as, say, 81 to 82 per cent at the full load. But the efficiency is much less on a varying load. Then, furthermore, we have got these variously estimated. I take the figures which I have found to be fair, giving this as the efficiency. Now the dynamo again has got mechanical losses due to friction, and, furthermore, the wire is never utilized fully in the dynamo. In my construction the dynamo may consist of a simple coil of the magnet, and a simpler coil which is all immersed in the magnetic field. There is no useless wire. Consequently, dynamo and engine, if they are reduced considerably in weight, increase in efficiency. There is only one engine which can equal it in output, and that is the turbine. With the steam turbine we can obtain an enormous output, and that is the reason why the steam turbine, in my opinion may be found a valuable adaptation for driving dynamos; and then convert the motion by means of alternating dynamos; and I think the steam turbine has in itself a physical cause why it cannot surpass a certain efficiency, and that is because we drive turbines by impact. A turbine might be very efficient if the medium which propels it were incompressible and homogeneous. But it cannot be efficient if we drive it by means of isolated shocks. Furthermore, we cannot in a turbine gain all the expansion. These causes, I think, will limit the efficiency obtained in turbines.

The steam turbine may have 80 per cent of mechanical efficiency, but I do not think such thermic efficiency can be reached in an apparatus like that. To offset this, I would say there is nothing to prevent the production of a reciprocating engine on the



plan I have mentioned, which would give the same weight and the same power. The power which a piston gives up during a stroke is proportional to the square of the amplitude. Now, with a very long stroke and a freely movable piston, we can reach any velocity, practically, that we want to. We can transform the energy of the piston by shooting a magnet through the field into electrical energy, and there is nothing in the way which would prevent, for instance, with some such mechanism as I have described, obtaining with that weight practically the same power as with the steam turbine. In fact, I think that the specific output of this mechanism is wonderful. Out of a little thing no more than three inches in diameter and four or five inches long, it is quite easy to obtain one horse-power with small stroke and fair pressure, so that the specific output of the apparatus, while it may tell on the efficiency in this way that it diminished the losses of condensation, is, of course, not a very remarkable thing in the steam turbine because in the steam turbine we have, besides, a very great loss in the clearance and, as I said, in the impact; whereas in the reciprocating mechanism we have not. Now I have shown some of my apparatus at the Fair, which was quite able, with a velocity of three and one half inches a second, to develop half a horse power with a pressure of 200 pounds -- a very little thing, no bigger than a glass.

In reciprocating mechanisms we can, provided we can obtain a sufficient high speed of the piston, expand the steam at an enormous rate. It is perfectly practicable in these mechanisms which I have been working up, to obtain, if you want, a speed of 100 meters a second, and while I do not contemplate producing such



speeds yet it is quite possible to do it. But since we can produce higher speeds, we might as well increase the speed two or three times, and so augment the activity of the mechanism and raise the efficiency. Furthermore, as I am enabled now to work without a packing -- I found that in these mechanisms the packing is actually objectionable -- the expansion occurs at an enormous rate, and the engine being of such character that the exhaust can be reduced to pretty nearly the atmospheric pressure very easily. The mechanical friction is reduced to such a small figure that we can raise the temperature of the steam very considerably. In high pressure steam engines one of the greatest troubles is the lubrication. We can go so far with the mineral oil, we can go so far with ordinary oil, but then we reach a point at which we cannot go any further, the lubricant will not work; and I am informed by very able practical engineers that about 250 pounds per square inch of steam pressure is as high as we may practically go. With this engine we can go much higher. I am now preparing a boiler which will give me up to 350 pounds pressure. It is very important, of course, to get the pressure very high. In these mechanisms we are confronted with two things: For what are they going to be used -- for light or for power? If we want to drive motors we must have a long stroke and a slow frequency. If we want to drive lamps then we want a very short stroke and a very rapid motion. To have a high speed with short stroke we must have a great initial pressure, because you know the number of vibrations increase only as the square root of the pressure. So if we want to have twice the number of vibrations we must have four times the



pressure. But, on the other hand, four times the pressure and twice the number of vibrations means eight times the output. So it is therefore very important in this mechanism in which the power depends on the square to obtain as high a pressure as possible. It is on this line now that I am working.

We have had such reciprocating engines as far back as 1868 or 1870 and it would be a very erroneous idea to think I had evolved something radically novel in that part of the mechanism.

It is more economical to produce rapid vibrations than low vibrations. But, so far as the economy of the dynamo is concerned, and so far as the economy of the engine in general is concerned, it is better to produce a long stroke, because a long stroke means a high velocity.

I have an apparatus which runs lights in the laboratory, and shortly, I think, I will have something which will be ready for practical application. I think I am not mistaken in believing that we are going to have, very shortly, a means at hand of producing twice as much electricity from coal as we can produce at the present time -- provided I am not mistaken. This is subject, of course, to a test, but I am quite confident that it can be done. This is not, however, a subject which occupies me altogether. There are also other subjects.



Presentation of the Edison Medal

to

Nikola Tesla

May 18, 1917

Acceptance remarks by Nikola Tesla

NIKOLA TESLA: Mr. President, Ladies and Gentlemen. - I wish to thank you heartily for your kind sympathy and appreciation. I am not deceiving myself in the fact, of which you must be aware, that the speakers have greatly magnified my modest achievements. One should in such a situation be neither diffident nor self-assertive, and in that sense I will concede that some measure of credit may be due to me for the first steps in certain new directions; but the ideas I advanced have triumphed, the forces and elements have been conquered, and greatness achieved, through the co-operation of many able men some of whom, I am glad to say, are present this evening. Inventors, engineers, designers, manufacturers and financiers have done their share until, as Mr. Behrend said, a gigantic revolution had been wrought in the transmission and transformation of energy. While we are elated over the results achieved we are pressing on, inspired with the hope and conviction that this is just a beginning, a forerunner of further and still greater accomplishments.

On this occasion, you might want me to say something of a personal and more intimate character bearing on my work. One of the speakers suggested: "Tell us something about yourself, about your early struggles." If I am not mistaken in this surmise I will, with your approval, dwell briefly on this rather delicate subject.

Some of you who have been impressed by what has been said, and would be disposed to accord me more than I have deserved, might be mystified and wonder how so much as Mr. Terry has outlined could have been done by a man as manifestly young as myself. Permit me to explain this. I do not speak often in public, and wish to address just a few remarks directly to the members of my profession, so that there will be no mistake in the future. In the first place, I come from a very wiry and long-lived race. Some of my ancestors have been centenarians, and one of them lived one hundred and twenty-nine years. I am determined to keep up the record and please myself with prospects of great promise. Then again, nature has given me a vivid imagination which, through incessant exercise and



Presentation of the Edison Medal

to

Nikola Tesla

May 18, 1917

Acceptance remarks by Nikola Tesla

NIKOLA TESLA: Mr. President, Ladies and Gentlemen. - I wish to thank you heartily for your kind sympathy and appreciation. I am not deceiving myself in the fact, of which you must be aware, that the speakers have greatly magnified my modest achievements. One should in such a situation be neither diffident nor self-assertive, and in that sense I will concede that some measure of credit may be due to me for the first steps in certain new directions; but the ideas I advanced have triumphed, the forces and elements have been conquered, and greatness achieved, through the co-operation of many able men some of whom, I am glad to say, are present this evening. Inventors, engineers, designers, manufacturers and financiers have done their share until, as Mr. Behrend said, a gigantic revolution had been wrought in the transmission and transformation of energy. While we are elated over the results achieved we are pressing on, inspired with the hope and conviction that this is just a beginning, a forerunner of further and still greater accomplishments.

On this occasion, you might want me to say something of a personal and more intimate character bearing on my work. One of the speakers suggested: "Tell us something about yourself, about your early struggles." If I am not mistaken in this surmise I will, with your approval, dwell briefly on this rather delicate subject.

Some of you who have been impressed by what has been said, and would be disposed to accord me more than I have deserved, might be mystified and wonder how so much as Mr. Terry has outlined could have been done by a man as manifestly young as myself. Permit me to explain this. I do not speak often in public, and wish to address just a few remarks directly to the members of my profession, so that there will be no mistake in the future. In the first place, I come from a very wiry and long-lived race. Some of my ancestors have been centennarians, and one of them lived one hundred and twenty-nine years. I am determined to keep up the record and please myself with prospects of great promise. Then again, nature has given me a vivid imagination which, through incessant exercise and



training, study of scientific subjects and verification of theories through experiment, has become very accurate and precise, so that I have been able to dispense, to a large extent, with the slow, laborious, wasteful and expensive process of practical development of the ideas I conceive. It has made it possible for me to explore extended fields with great rapidity and get results with the least expenditure of vital energy. By this means I have it in my power to picture the objects of my desires in forms real and tangible and so rid myself of that morbid craving for perishable possessions to which so many succumb. I may say, also, that I am deeply religious at heart, although not in the orthodox meaning, and that I give myself to the constant enjoyment of believing that the greatest mysteries of our being are still to be fathomed and that, all the evidence of the senses and the teachings of exact and dry sciences to the contrary notwithstanding, death itself may not be the termination of the wonderful metamorphoses we witness. In this way I have managed to maintain an undisturbed peace of mind, to make myself proof against adversity, and to achieve contentment and happiness to a point of extracting some satisfaction even from the darker side of life, the trials and tribulations of existence. I have fame and untold wealth, more than this, and yet - how many articles have been written in which I was declared to be an impractical unsuccessful man, and how many poor, struggling writers, have called me a visionary. Such is the folly and shortsightedness of the world!

Now, that I have explained why I have preferred my work to the attainment of worldly rewards, I will touch upon a subject which will lend me to say something of greater importance and enable me to explain how I invent and develop ideas. But first I must say a few words regarding my life which was most extraordinary and wonderful in its varied impressions and incidents. In the first place, it was charmed. - You have heard that one of the provisions of the Edison Medal was that the recipient should be alive. Of course the men who have received this medal have fully deserved it, in that respect, because they were alive when it was conferred upon them, but none has deserved it in anything like the measure I do, when it comes to that feature. In my youth my ignorance and lightheartedness brought me into innumerable difficulties, dangers and scrapes, from which I extricated myself as by enchantment. That occasioned my parents great concern more, perhaps, because I was the last male than because I was of their own flesh and blood. You should know that Serbians desperately cling to the preservation of the race. I was nearly drowned a dozen times. I was almost cremated three or four times and just missed being boiled alive. I was buried, abandoned and frozen. I have had narrow escapes from mad dogs, hogs and other wild animals. I have passed through dreadful diseases - have been given up by physicians three or four times in my life for good. I have met with all sorts of odd accidents - I cannot think of anything that did not happen to me, and to realize that I am here this evening, hale and hearty, young in mind and body, with all these fruitful years behind me, is little short of a miracle.

But my life was wonderful in another respect - in my capacity of inventor. Not so much, perhaps, in concentrated mentality, or physical endurance and energy; for these are common enough. If you



inquire into the career of successful men in the inventor's profession you will find, as a rule, that they are as remarkable for their physical as for their mental performance. I know that when I worked with Edison, after all of his assistants had been exhausted, he said to me: "I never saw such a thing, you take the cake." That was a characteristic way for him to express what I did. He worked from half past ten in the morning until five o'clock the next morning. I carried this on for nine months without a single day's exception; everybody else gave up. Edison stuck, but he occasionally dozed off on the table. What I wish to say particularly is that my early life was really extraordinary in certain experiences which led to everything I ever did afterwards. It is important that this should be explained to you as otherwise you would not know how I discovered the rotating field. From childhood I was afflicted in a singular way - I would see images of objects and scenes with a strong display of light and of much greater vividness than those I had observed before. They were always images of objects and scenes I had actually seen, never of such as I imagined. I have asked students of psychology, physiology and other experts about it, but none of them has been able to explain the phenomena which seems to have been unique, although I was probably predisposed, because my brother also saw images in the same way. My theory is that they were simply reflex actions from the brain on the retina, superinduced by hyper-excitation of the nerves. You might think that I had hallucinations. That is impossible. They are produced only in diseased and anguished brains. My head was always clear as a bell, and I had no fear. Do you want me to tell of my recollections bearing on this? (Turning to the gentlemen on the platform). This is traditional with me, for I was too young to remember anything of what I said. I had two old aunts, I recall, with wrinkled faces, one of them with two great protruding teeth which she used to bury into my cheek when she kissed me. One day they asked me which of the two was prettier. After looking them over I answered: "This one is not as ugly as the other one." That was evidence of good sense. Now as I told you, I had no fear. They used to ask me, "Are you afraid of robbers?" and I would reply "No". "Of wolves?" "No". Then they would ask, "Are you afraid of crazy Luka?" (A fellow who would tear through the village and nothing could stop him) "No, I am not afraid of Luka." "Are you afraid of the gander?" "Yes, I am," I would reply and cling to my mother. That was because once they put me in the court yard with - nothing on, and that beast ran up and grabbed me by the soft part of the stomach tearing off a piece of flesh. I still have the mark.

These images I saw caused me considerable discomfort. I will give you an illustration: Suppose I had witnessed a funeral. In my country the rites are but intensified torture. They smother the dead body with kisses, then they bathe it, expose it for three days, and finally one hears the dull thuds of the earth, when all is over. Some of the pictures as that of the coffin, for instance, would not only appear vividly but were sometimes so persistent that when I would stretch my hand out I would see it penetrate the image. As I look at it now these images were simply reflex actions through the optic nerve on the retina, producing on the same an effect identical to that of a projection through the lens, and if my view is



correct, then it will be possible, (and certainly my experience has demonstrated that), to project the image of any object one conceives in thought on a screen and make it visible. If this could be done it would revolutionize all human relations. I am convinced that it can and will be accomplished.

In order to free myself of these tormenting appearances, I tried to fix my mind on some other picture or image which I had seen, and in this way I would manage to get some relief; but in order to get this relief I had to let the images come one after the other very fast. Then I found that I soon exhausted all I had at my command, my "reel" was out, as it were. I had seen little of the world, only objects around my own home, and they took me a few times to some neighbors, that was all I knew. When I did so the second or third time, in order to chase the appearance from my vision, I found that this remedy lost all the force. Then I began to make excursions beyond the limits of the little world I knew, and I saw new scenes. These were at first very blurred and indistinct, and would flit away when I tried to concentrate my attention upon them, but by and by I succeeded in fixing them; they gained in force and distinctness and finally assumed the intensity of real things. Soon I observed that my best comfort was attained if I simply went on in my vision farther and farther, getting new impressions all the time, and so I started to travel - of course, in my mind. You know that there have been great discoveries made - when Columbus found America that was one, but when I hit upon the idea of traveling it seemed to me that was the greatest discovery possible to man. Every night (and sometimes during the day), as soon as I was alone I would start on my travels. I would see new places, cities and countries, I would live there, meet people and make friendships and acquaintances, and these were just as dear to me as those in real life and not a bit less intense. That is the way I did until I reached almost manhood. When I turned by thoughts to invention, I found that I could visualize my conceptions with the greatest facility. I did not need any models, drawings or experiments, I could do it all in my mind, and I did. In this way I have unconsciously evolved what I consider a new method of materializing inventive concepts and ideas, which is exactly opposite to the purely experimental of which undoubtedly Edison is the greatest and most successful exponent. The moment you construct a device to carry into practice a crude idea you will find yourself inevitable engrossed with the details and defects of the apparatus. As you go on improving and reconstructing, your force of concentration diminishes and you lose sight of the great underlying principle. You obtain results, but at the sacrifice of quality. My method is different, I do not rush into constructive work. When I get an idea, I start right away to build it up in my mind. I change the structure, I make improvements, I experiment, I run the device in my mind. It is absolutely the same to me whether I operate my turbine in thought or test it actually in my shop. It makes no difference, the results are the same. In this way, you see, I can rapidly develop and perfect an invention, without touching anything. When I have gone so far that I have put into the device every possible improvement I can think of, that I can see no fault anywhere, I then construct this final product of my brain. Every time my device works as I conceive it should and my experiment comes out exactly as I plan it. In twenty years there has not been a single solitary experiment which did not turn out precisely as I thought it would. Why should it not? Engineering, electrical



and mechanical, is positive in results. Almost any subject presented can be mathematically treated and the effects calculated; but if it is such that results cannot be had by simple methods of mathematics or short cuts, there is all the experience, and all the data on which to draw and from which to build; - why, then, should one carry out the crude idea? It is not necessary, it is a waste of energy, money and time. Now, that is just the way I produced the rotating field.

If I am to give you in a few words the history of that invention, I must begin with my birthday, and you will see the reason why. I was born exactly at midnight, I have no birthday and I never celebrate it. But something else must have happened on that date. I have learned that my heart beat on the right side and did so for many years after. As I grew up it beat on both sides, and finally settled on the left. I remember that I was surprised, when I developed into a very strong man, to find my heart on the left side. Nobody understands how it happened. I had two or three falls and on one occasion nearly all my chest bones were crushed in. Something that was quite unusual must have occurred at my birth and my parents destined me for the clergy then and there. When I was six years old I managed to have myself imprisoned in a little chapel at an inaccessible mountain, and visited only once a year. It was a place of many bloody encounters and there was a grave yard near by. I was locked in there while looking for some sparrows' nests, and had the most dreadful night I ever passed in my life, in company with the ghosts of the dead. American boys will not understand it, of course, for there are no ghosts in America - the people are too sensible; but my country was full of them, and every one from the small boy up to the greatest hero, who was plastered all over with medals for courage and bravery, had a fear of ghosts. Finally, as by a wonder, they rescued me, and then my parents said: "Surely he must go to the clergy, he must become a churchman." Whatever happened after that, no matter what it was, simply fortified them in that resolution. One day, to tell you a little story, I fell from the top of one of the farm buildings into a large kettle of milk, which was boiling over a roaring fire. Did I say boiling milk? - It was not boiling - not according to the thermometer - though I would have sworn it was when I fell into it, and they pulled me out. But I only got a blister on the knee where I struck the hot kettle. My parents said again: "Was not that wonderful? Did you ever hear of such a thing? He will surely be a bishop, a metropolitan, perhaps a patriarch." In my eighteenth year I came to the cross roads. I had passed through the preliminary schools and had to make up my mind either to embrace the clergy or to run away. I had a profound respect for my parents, and so I resigned myself to take up studies for the clergy. Just then one thing occurred, and if it had not been for that, I would not have had my name connected with the occasion of this evening. A tremendous epidemic of cholera broke out, which decimated the population and, of course, I got immediately. Later it developed into dropsy, pulmonary trouble, and all sorts of diseases until finally my coffin was ordered. In one of the fainting spells when they thought I was dying, my father came to my bedside and cheered me: "You are going to get well." "Perhaps," I replied, "if you will let me study engineering." "Certainly I will," he assure me, "you will go to the best polytechnic school in Europe." I recovered to the amazement of everybody. My father



kept his word, and after a year of roaming through the mountains and getting myself in good physical shape, I went to the Polytechnic School at Gratz, Styria, one of the oldest institutions. Something else occurred, however, of which I must tell you as it is vitally linked with this discovery. In the preparatory schools there was no liberty in the choice of subjects, and unless a student was proficient in all of them he could not pass. I found myself in this predicament every year. I could not draw. My faculty for imagining things paralyzed whatever gift I might have had in this respect. I have made some mechanical drawings, of course; practicing so many years one must needs learn to make simple sketches, but if I draw for half an hour I am all exhausted. I never was qualified and passed only through my father's influence. Now, when I went to the polytechnic school I had free choice of subjects and proposed myself to show my parents what I could do. The first year on the polytechnic school was spent in this way - I got up at three o'clock in the morning and worked until eleven o'clock at night, for one whole year, with a single day's exception. Well, you know when a man with a reasonable healthy brain works that way he must accomplish something. Naturally, I did. I graduated nine times that year and some of the professors were not satisfied with giving me the highest distinction, because they said, that did not express their idea of what I did, and here is where I come to the rotating field. In addition to the regular graduating papers they gave me some certificates which I brought to my father believing that I had achieved a great triumph. He took the certificates and threw them into the waste basket, remarking contemptuously: "I know how these testimonials are obtained." That almost killed my ambition; but later, after my father had died, I was mortified to find a package of letters, from which I could see that there had been considerable correspondence going on between him and the professors who had written to the effect that unless he took me away from school I would kill myself with work. Then I understood why he had slighted my success, which I was told was greater than any previous one at that institution; in fact the best students had only graduated twice. My record in the first year had the result that the professors became very much interested in and attached to me, particularly three of them; Prof. Rogner who was teaching arithmetical subjects and geometry; Prof. Alle, one of the most brilliant and wonderful lecturers I have ever seen, who specialized in differential equations, about which he wrote quite a number of works in German, and Prof. Foeschl, who was my instructor in physics. These three men were simply in love with me and used to give me problems to solve. Prof. Foeschl was a curious man. I never saw such feet in my life. They were about that size. (Indicating) His hands were like paws, but when he performed experiments they were so convincing and the whole went off so beautifully that one never realized now they were done. It was all in the method. He did all with the precision of a clock work, and everything succeeded.

It was in the second year of my studies that we received a Gramme machine from Paris, having a horse-shoe for of laminated magnet, and a wound armature with a commutator. We connected it up and showed various effects of currents. During the time Prof. Foeschl was making demonstrations running the machine as motor we had some trouble with the brushes. They sparked very badly, and I observed: "Why should not we operate with the brushes?" Prof. Foeschl declared that it could not be done, and in view of my success in the past year he did me the honor of delivering a lecture touching on



the subject. He remarked: "Mr. Tesla may accomplish great things, but he certainly never will do this," and he reasoned that it would be equivalent to converting a steadily pulling force, like that of gravity, into a rotary effort, a sort of perpetual motion scheme, an impossible idea. But you know that instinct is something which transcends knowledge. We have, undoubtedly certain finer fibers that enable us to perceive truths when logical deduction, or any other willful effort of the brain, is futile. We cannot reach beyond certain limits in our reasoning, but with instinct we can go to very great lengths. I was convinced that I was right and that it was possible. It was not a perpetual motion idea, it could be done, and I started to work at once.

I will not tire you with an extended account of this undertaking, but will only say that I began in the summer of 1877 and I proceeded as follows: I would picture, first of all, a direct-current machine, run it and see how the currents changed in the armature. Then I would imagine an alternator and do the same thing. Next I would visualize systems comprising motors and generators, and so on. Whatever apparatus I imagined, I would put together and operate in my mind, and I continued this practice incessantly until 1882. In that year somehow or other, I began to feel that a revelation was near. I could not yet see just exactly how to do it, but I know that I was approaching the solution. While on my vacation, in 1882, sure enough, the idea came to me and I will never forget the moment. I was walking with a friend of mine in the city park of Budapest reciting passages from Faust. It was nothing for me to read from memory the contents of an entire book, with every word between the covers, from the first to the last. My sister and brother, however, could do much better than myself. I would like to know whether any of you has that kind of a memory. It is curious, entirely visual and retroactive. To be explicit - when I made my exams, I had always to read the books three or four days if not a week before, because in that time I could reconstruct the images and visualize them: but if I had an examination the next day after reading, images were not clear and the remembrance was not quite complete. As I say, I was reciting Goethes poem, and just as the sun was setting I felt wonderfully elated, and the idea came to me like a flash. I saw the whole machinery clearly, the generator, the motor, the connections, I saw it work as if it had been real. With a stick I drew on the sand the diagrams which were shown in my paper before the American Institute of Electrical Engineers and illustrated in my patents, as clearly as possible, and from that time on I carried this image in my mind. Had I been a man possessed of the practical gifts of Edison, I would have gone right away to perform an experiment and push the invention along, but I did not have to do this. I could see pictures so vividly, and what I imagined was so real and palpable, that I did not need any experimenting, nor would it have been particularly interesting to me. I went on and improved the plan continuously, inventing new types, and the day I came to America, practically every form, every kind of construction, every arrangement of apparatus I described in my thirty or forty patents was perfected, except just two or three kinds of motors which were the result of later development.



In 1823, I made some tests in Strasburg, as Mr. Terry pointed out, and there at the railroad station obtained the first rotation. The same experiment was repeated twice.

Now I come to an interesting chapter of my life, when I arrived in America. I had made some improvements in dynamos for a French company who were getting their machinery from here. The improved forms were so much better that the manager of the works said to me: "You must go to America, and design the machines for the Edison Company." So, after ineffectual efforts on the other side to get somebody to interest himself in my plans financially, I came to this country. I wish that I could only give you an idea how what I saw here impressed me. You would be very much astonished. You have all undoubtedly read those charming Arabian Nights tales, in which the genii transports people into wonderful regions, to go through all sorts of delightful adventures. My case was just the opposite. The genii transported me from a world of dreams into one of realities. My world was beautiful, ethereal, as I could imagine it. The one I found here was a machine world; the contact was rough, but I liked it. I realized from the very moment I saw Castle Garden that I was a good American before I landed. Then came another event. I met Edison, and the effect he produced upon me was extraordinary. When I saw this wonderful man, who had had no theoretical training at all, no advantages, who did all himself, getting great results by virtue of his industry and application, I felt mortified that I had squandered my life. I had studied a dozen languages, delved in literature and art and had spent my best years in ruminating through libraries and reading all sorts of stuff that fell into my hands. I thought to myself, what a terrible thing it was to have wasted my life in those useless efforts. If I had only come to America earlier and devoted all of my brain power to inventive work, what might I have done? In later life though, I realized I would not have produced anything without the scientific training I got, and it is a question whether my surmise as to my possible accomplishment was correct. In Edison's works I passed nearly a year of the most strenuous labor, and then certain capitalists approached me with the project to form my own company. I went into the proposition, and developed an arc light. To show you how prejudiced people were against the alternating-current, as the President has indicated, when I told these friends of mine that I had a great invention relating to alternating-current transmission, they said: "No, we want the arc lamp. We do not care for this alternating-current." Finally I perfected my lighting system and the city adopted it. Then I succeeded in organizing another company, in April, 1886, and a laboratory was put up, where I rapidly developed these motors, and eventually the Westinghouse people approached us, and an arrangement was made for their introduction. You know what has happened since then. The invention has swept the world.

I should like to say just a few words regarding the Niagara Falls enterprise. We have a man here to-night to whom belongs really the credit for the early steps and for the first financiering of the project, which was difficult at that time. I refer to Mr. E. D. Adams. When I heard that such authorities as Lord Kelvin and Prof. W. C. Unwin had recommended - one the direct-current system and the other compressed air - for the transmission of power from Niagara Falls to Buffalo, I thought it was dangerous to let the matter go further, and I went to see Mr. Adams. I remember the inter-



view perfectly. Mr. Adams was much impressed with what I told him. We had some correspondence afterwards, and whether it was in consequence of my enlightening him on the situation, or owing to some other influence, my system was adopted. Since that time, of course, new men, new interests have come in, and what has been done I do not know, except that the Niagara Falls enterprise was the real starting impulse in the great movement inaugurated for the transmission and transformation of energy on a huge scale.

Mr. Terry has referred to other inventions of mine. I will just make a few remarks relative to these as some of my work has been misunderstood. It seems to me that I ought to tell you a few words about an effort that absorbed my attention later. In 1892 I delivered a lecture at the Royal Institution and Lord Rayleigh surprised me by acknowledging my work in very generous terms, something that is not customary, and among other things he stated that I had really an extraordinary gift for invention. Up to that time, I can assure you, I had hardly realized that I was an inventor at all. I looked upon the floating field discovery as simply a mathematical, logical, step by step deduction. I arrived at this invention by sheer force or energy, by using screws and levers, as it were. I did not get an inspiration, it seemed to me. My machines were fully developed in my mind. When I tried the first experiments they meant nothing to me. I had already demonstrated them perfectly. So, when I went home, in 1892, and read these remarks of Lord Rayleigh, I began to think and convinced myself that I was an inventor. I remembered, for instance, when I was a boy, I could go out into the forest and catch as many crows as I wanted, and nobody else could do it. Once, when I was seven years of age, I repaired a fire engine which the engineers could not make work, and they carried me in triumph through the city. I constructed turbines, clocks and such devices as no other boy in the community. I said to myself: "If I really have a gift for invention, I will bend it to some great purpose or task and not squander my efforts on small things." Then I began to ponder just what was the greatest deed to accomplish. One day as I was walking in the forest a storm gathered and I ran under a tree for shelter. The air was very heavy, and all at once there was a lightning flash, and immediately after a torrent of rain fell. That gave me the first idea. I realized that the sun was lifting the water vapor, the wind swept it over the regions where it accumulated and reached a condition when it was easily condensed and fell to earth again. This life-sustaining stream of water was entirely maintained by sun power, and lightning, or some other agency of this kind, simply came in as a trigger-mechanism to release the energy at the proper moment. I started out and attacked the problem of constructing a machine which would enable us to precipitate this water whenever and wherever desired. If this was possible, then we could draw unlimited amounts of water from the ocean, create lakes, rivers and water falls, and indefinitely increase the hydroelectric power, of which there is now a limited supply. That led me to the production of very intense electrical effects. At the same time my wireless work, which I had already begun, was exactly in that direction, and I devoted myself to the perfection of that device, and in 1908, I filed an application describing an apparatus with which I thought the wonder could be achieved. The Patent Office Examiner was from Missouri, he would not believe that it could be done, and my patent was



never granted. But in Colorado I had constructed a transmitter by which I produced effects in some respects at least greater than those of lightning. I do not mean in potential. The highest potential I reached was something like 20,000,000 volts, which is insignificant as compared to that of lightning, but certain effects produced by my apparatus were greater than those of lightning. For instance, I obtained in my antennae currents of from 1,000 to 1100 amperes. That was in 1899 and you know that in the biggest wireless plants of today only 250 amperes are used. In Colorado I succeeded one day in precipitating a dense fog. There was a mist outside, but when I turned on the current the cloud in the laboratory became so dense that when the hand was held only a few inches from the face it could not be seen. I am positive in my conviction that we can erect a plant of proper design in an arid region, work it according to certain observations and rules, and by its means draw from the ocean unlimited amounts of water for irrigation and power purposes. If I do not live to carry it out, somebody else will, but I feel sure that I am right.

As to the transmission of power through space, that is a project which I have considered absolutely certain of success long since. Years ago I was in the position to transmit wireless power to any distance without limit other than that imposed by the physical dimensions of the globe. In my system it makes no difference what the distance is. The efficiency of the transmission can be as high as 96 or 97 per cent, and there are practically no losses except such as are inevitable in the running of the machinery. When there is no receiver there is no energy consumption anywhere. When the receiver is put on, it draws power. That is the exact opposite of the Hertz-wave system. In that case, if you have a plant of 1000 horsepower, it is radiating all the time whether the energy is received or not; but in my system no power is lost. When there are no receivers the plant consumes only a few horsepower necessary to maintain the electric vibration; it runs idle, as the Edison plant when the lamps and motors are shut off.

I have made advances along this line in later years which will contribute to the practical features of the system. Recently I have obtained a patent on a transmitter with which it is practicable to transfer unlimited amount of energy to any distance. I had a very interesting experience with Mr. Stone, whom I consider, if not the ablest, certainly one of the ablest living experts. I said to Mr. Stone: "Did you see my patent?" He replied: "Yes, I saw it, but I thought you were crazy." When I explained it to Mr. Stone he said, "Now, I see; why, that is great," and he understood how the energy is transmitted.

To conclude, gentlemen, we are coming to great results, but we must be prepared for a condition of paralysis for quite a while. We are facing a crisis such as the world has never seen before, and until the situation clears the best thing we can do is to devise some scheme for overcoming the submarines, and that is what I am doing now. (Applause)

ALFRED H. COWLES: Here are some pictures you gave to me twenty years ago, relating to your experiments of 1889, I think you will be interested in seeing them. (Hands pictures to Mr. Tesla)



NIKOLA TESLA: I have learned how to put up a plant that will develop a tension of 100,00,000 volts and handle it with perfect safety. This plant (indicating) was in Colorado. If anybody, who had not been dabbling in these experiments as long as myself, had done such work, he would surely have been killed. In this plant I had the narrowest escape ever. It was a square building, in which there was a coil 52 feet in diameter, about nine feet high. When it was adjusted to resonance, the streamers passed from top to bottom and it was a most beautiful sight. You see, that was about fifteen hundred, perhaps two thousand square feet of streamer surface. To save money I had calculated the dimensions as closely as possible, and the streamers came within six or seven inches from the sides of the building. As boys had been looking through a single window provided in the rear, I nailed it up. For handling the heavy currents, I had a special switch. It was hard to pull, and I had a spring arranged so that I could just touch the handle and it would snap in. I sent one of my assistants down town and was experimenting alone. I threw up the switch and went behind the coil to examine something. While I was there the switch snapped in, when suddenly the whole room was filled with streamers, and I had no way of getting out. I tried to break through the window but in vain as I had no tools, and there was nothing else to do than to throw myself on my stomach and pass under. The primary carried 50,000 volts, and I had to crawl through the narrow place here (pointing) with the streamers going. The nitrous acid was so strong I could hardly breathe. These streamers rapidly oxidize nitrogen because of their enormous surface, which makes up for what they lack in intensity. When I came to the narrow space they closed on my back. I got away and barely managed to open the switch when the building began to burn. I grabbed a fire extinguisher and succeeded in smothering the fire. Then I had enough, I was all in. But now I can operate a plant without any fear of its destruction by fire. Mr. Cowles is responsible for the excursion into this matter.

THE PRESIDENT: It there is no further business, we will consider this meeting as adjourned.

The meeting then adjourned.



Minutes of the Edison Medal Meeting only  
partially reprinted in Electrical Review  
and Western Electrician - May 26, 1917,  
and in reprint of this in Tribute to  
Nikola Tesla



MINUTLS OF THE ANNUAL MEETING OF THE AMERICAN INSTITUTE  
OF ELECTRICAL ENGINEERS, HELD AT THE ENGINEERING SOCIETIES  
BUILDING, NEW YORK CITY, FRIDAY EVENING, May 18, 1917.

-----0-----

President Buck called the meeting to order at 8:30 o'clock.

THE PRESIDENT: As you know, gentlemen, this is the Annual Meeting of the Institute, and the first thing on the program will be the presentation of the Report of the Board of Directors by our Secretary, Mr. Hutchinson.

SECRETARY HUTCHINSON: The annual report of the Institute for the year has been printed and distributed, and it is not my intention to take the time to read it. It consists of a brief resume of the activities of the Institute for the entire year, and includes abstracts of the reports of the various committees.

(Secretary Hutchinson then abstracted the Report of the Board of Directors)

THE PRESIDENT: Gentlemen, the next order of business of the evening will be the announcement of the election of officers and managers for the coming year. The report of the Tellers will be present by the Secretary, Mr. Hutchinson.

Secretary Hutchinson then presented the report of the Tellers, which showed elections as follows:

President	W. W. Rice, Jr.
Vice-Presidents:	Frederick Bedell, John H. Finney, A. S. McAllister
Managers: (term expiring July 31, 1921)	Walter A. Hall, E. H. Martindale, William A. DelMar, Wilfred Sykes
Treasurer:	George A. Hamilton

(The President then declared the foregoing-named gentlemen as duly elected officers and managers of the Institute as indicated)

THE PRESIDENT: It is our privilege from time to time to honor those in the electrical profession who have rendered conspicuous service towards this advance. We have the pleasure this evening of so honoring Mr. Nikola Tesla. Dr. Kennelly, who is Chairman of the Edison Medal Committee, will tell us what the Edison Medal is and what it stands for. I take pleasure in introducing Dr. A. E. Kennelly.

DR. A. E. KENNELLY: Mr. President, Ladies and Gentlemen:



It is my privilege to say a few words to you upon the origin and purpose of the Edison Medal. First of all, many people suppose that the Edison Medal is a medal presented by Mr. Edison. That is a mistake. Mr. Edison has been so busy during his life receiving medals that he has not time for the delivery of any. The Edison Medal owes its existence to the action of a group of his admirers who in a very remarkable Deed of Gift, a printed copy of which I have here, have set apart a fund for the purpose of the annual award of a medal for meritorious achievement in electrical science and art. This deed of gift originally recited, in 1904, that the medal should be annually awarded for the best graduating thesis by the students of electrical engineering in the United States and Canada, but in the years that elapsed between 1904 and 1908, I think I am correct in saying that there were no successful candidates, at least for the medal under those terms, although there may have been many aspirants. It is supposed that the dignity of the medal and the junior character of the tyros restrained them in their modest from making proper application.

Be that as it may, finding that the applicants held back under the original terms of the deed of gift, the matter was taken up further and the original body of men recrafted the deed and placed it in the hands of the American Institute of Electrical Engineers to award the medal, under the choice of a Committee, annually, for meritorious achievement, as indicated, to any resident of the United States, its dependencies, or Canada, during each administration year. The monument which they raised to Mr. Edison by their act is, I think you will admit, one of the most wonderful that has ever been raised to any scientist.

The Deed of Gift says that there shall be twenty-four members appointed by the American Institute of Electrical Engineers, sixteen from the membership at large, three ex-officio members, the president, Secretary and Treasurer, and the balance from the members of the Board of Directors.

Every year the medal is due to be awarded. There have been already six medal awarded, not counting the medal which is to be awarded to-night, and the recipients of these medals have been Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell. I think you will say that that is a fitting selection for the galaxy of names that we look forward to in the future, all of them, in honoring Mr. Edison's achievements, which have been so noteworthy, that every household in the land holds his name as a cherished household word. We may look forward to a time say a thousand years hence, when, like this evening, the American Institute of Electrical Engineers, or its successors or assigns, shall be convoked, and at which the medal of the year will be awarded to its One Thousand and Seventh recipient, and all that long galaxy of names will represent those individuals who have contributed to the recognition of the achievements of Mr. Edison and his gift to humanity.



In addition to what this deed of gift shows in honor of Mr. Edison himself, there is, of course, the very great honor that it bestows upon the recipient. The Deed of Gift says there shall be twenty-four jurors, which you see is twice the number of jurors that is allowed in the palladium of our liberties, but whereas the jurors of ordinary life convict by unanimous vote, the twenty-four jurors of the Edison Medal convict, at least, by a two-thirds vote, so I think I am correct in saying that their convictions have hitherto been entirely unanimous, and in this particular case I can certainly declare that it has been unanimous.

The galaxy of names that will be produced and has already been produced under this deed of gift will be great and noteworthy. It will not be necessary to look into a "Who's Who" to see who has been great and notorious and worthy of merit in electrical science and art. The historian of the future will simply say - "Give me the list of the Edison Medallists."

This deed of gift is also wonderful in other respects. It has marvelous flexibility and marvelous rigidity in certain directions. It provides for the possibility of a change of personnel, a change of procedure and a change of administration as time and things may change. It only makes one rigid restriction, and that is that the name "Edison Medal" shall never be changed. Times may change and persons and institutions, the Institute itself may go out of existence, and there is provided machinery whereby if the Institute should say it is tired, or it has gone out of existence, or can no longer administer the medal, that the five oldest universities of the country, maintaining a course in electrical engineering, shall be able to place the administration of the medal by their vote in the hands of some new institution, so you see that this is a very wonderful Deed of Gift that I have the honor of bringing to your notice here this evening in connection with the bestowal of this Medal. Another great advantage that the medal presents is that its recipient shall be alive, that is to say, he must not only have been convicted of great merit and meritorious achievement, but he must also have escaped being run over by automobiles up to the time of the presentation. That represents a great advance over those methods of awarding distinction which depend upon the demise of the individual. You know somebody has said that a great statesman is a successful politician who is dead, but we may say that the Edison Medallist is a great electrician who is alive, and you know it is wonderful how little is known sometimes about a man's demise, however much may be known about his work. The other day I met a negro in the South, and I happened to mention Washington, and what was done by George Washington who died so many years ago, and he said, "For de Lawd's sake, I doant ever heard the man was sick." So you see that even George Washington, no matter how meritorious he might have been in electrical matters, could not possibly be the recipient of an Edison Medal.



We have recently received the sad news in this country of the demise of the great English electrical engineer Silvanus P. Thomson, a man who had many admirers and many friends in this country, many students here, a man whose name and work is dear to so many of us, and efforts are now being made to contribute to a fitting memorial for him by the purchase of his library as an appendix to the great library of the British Institution of Electrical Engineers, and a notice is given on page 126 of the May Proceedings of the Institute regarding that movement, and you will find it a very worthy movement. Subscription lists are open to the members of this Institute, as a matter of courtesy, and a matter of recognition, that so many of his friends in this country could be allowed to give some contribution to this great Thomson Memorial. It is a fact, as I dare say many of you know, that the funds for Lord Kelvin's Memorial Window in Westminster Abbey were largely raised in America, more largely, I believe, than they were in England itself. In this case I am led to believe that they do not want the funds so much, as they want the names of sympathizers with the project, the support of those who recognize the work and merit of Silvanus P. Thompson. But how much better it would be if we were presenting a memorial to Silvanus P. Thompson living, as we are able to do in the case of the Edison Medal, than presenting a memorial to Silvanus P. Thomson passed away.

Then one thing more: This deed of gift between its lines suggests a third and by no means least important purpose, and that is a safeguard, lest we forget. We in this time and of this continent, particularly we of the electrical profession, with our faces ever turned to the rising sun, are so apt to forget that there has been a preceding night of trouble, difficulty and dismay, and that the tools of our trade which lie to our hand were only secured by hard work and toil against all sorts of distress and discouragements. The Edison Medal is our means for reviving your memories of the past and pointing out that the things we look upon as the sunshine of heaven now have been arrived at by the hard work, the inspiration, or, as Edison himself would say, the perspiration of those who have worked in the past.

We remember that beautiful book, "The Twins", where Budge and Toddy the children always insisted at all times of the day and night to see the wheels go 'round and have their father's watch opened for them. The medallist to-night was a man who saw in his mind wheels going around when there was no means of getting alternating current motors to rotate, when the alternating current would do everything but make wheels go 'round, and he devised the rotating magnetic field so prophetically in his mind's eye that the rotating magnetic wheel would set wheels going 'round all over the land and all over the world, and the vision is carried out, and we recognize that vision here, and the Medal is partly as a reminder that we should not forget the fact, that the medallist also made the phenomenon of high frequency known to us



all practically for the first time, and that what he showed was a revelation to science and art unto all time.

For this third purpose the Edison Medal has been created, and we may look far forward into the future and see it given year after year for, let us hope, as great meritorious achievement as in the case upon the present occasion. The only thing we regret is that we cannot hope, a thousand years from now, in the year 2917, to witness the ceremony which we may well expect will be furnished at that time. (applause)

THE PRESIDENT: Dr. Kennelly has referred to the struggles of the past, and we are very fortunate in having with us to-night one who was associated with Mr. Tesla in his struggles of the past. Gentlemen, I want to introduce to you Mr. Charles A. Terry, who will tell us something about these struggles and the early work of Mr. Tesla, for which we assign to him the Medal to-night.

CHARLES A. TERRY: Mr. Kennelly spoke of the thousandth award of the Medal. I think there is a peculiar significance in the fact that Mr. Tesla is to receive the seventh medal - the seventh in most calculations is considered a most excellent number to have.

The convolutions of the brain of one man impel him to paint upon canvass the visions of his soul; another conceives beauty of form which he must express in plastic art or in architectural structure; others are driven by an inner force to devote their lives to the discovery of the secrets of unexplored regions of the earth, or to search out the mysteries of the stars; some find themselves compelled by an irresistible desire to learn through archeological research the forgotten achievements of ancient races; still others seek to ascertain and formulate the physical laws which govern the processes of nature, and men with other talents find themselves urged by a like persistent force to devise and disclose new means whereby those laws may be utilized for the further benefit of mankind.

It is this God-given desire to accomplish and to give, that has produced the Michael Angelos, the Galilios, the Sir Christopher Wrens, the Livingstons, Newtons, Franklins, Westinghouses, Edisons and scores of other makers of history; men whose names we retain in affectionate remembrance, because they earnestly responded to the call from within and by patient toil conceived thoughts and discovered things of value which they promulgated for the benefit of their fellow men.

Although hope of reward may and properly should exist as an added impulse to such endeavors, the chiefly effective force compelling to the long hours of hard work and person sacrifices of such men is the "I must" which speaks from within the soul, and with our truly great men the desire for reward is better satisfied by a consciousness of achieving their aims and by the just commendation of their fellows than by material gain, except insofar as the latter may aid in the further advancement of their tasks.



Fortunately, men generally are not jealous nor envious of the doers of great deeds and the givers of large benefits, but from the depths of their hearts are grateful and they are satisfied only when evidence of their gratitude can be brought home to the giver.

It is because of this desire to show gratitude to, and appreciation of, one of our fellow members, whose name history will rightly record in the same distinguished class with those we have mentioned that we are gathered tonight.

Twenty-nine years ago this month, there was presented before this Institute, a paper of unusual import. It is intitled "A New System of Alternate Current Motors and Transformers". The author, Nikola Tesla, was then only 31 years of age, and but four years a resident of this country. His early life was spent near his birthplace not far from the Eastern Adriatic Coast. His father a Greek Clergyman and his mother, herself of an inventive mind, secured for their young son a comprehensive training in mathematics, physics and philosophy. At the age of 22 he had completed his studies in engineering at the Polytechnique School in Gratz and also a course in the University of Prague; and in 1881 began his practical work at Budapest. In 1883 he was located at Strasbourg, engaged in completing the lighting of a newly erected railway station. Shortly after finishing this task he came to the United States. Mr. Tesla's first work in this country was upon new designs of direct current arc and incandescent lighting systems for the Edison Company.

Throughout all these years his desire had been to find an opportunity to demonstrate the truth of a conviction which became fixed in his mind while studying direct current motors in school at Gratz in 1878; the conviction was that it should be possible to create a rotating magnetic field without the use of commutators. While at Strasbourg, Tesla had succeeded in producing the rotation of a pivoted iron disc placed in a coil traversed by alternating currents, a steel bar being projected into the coil in the neighborhood of the disc. His conception of the reason for this rotation at that time was that a lag occurred in the subsidence of the magnetism of both the disc and the steel bar between successive current waves, and that the mutual repulsions caused the disc to revolve. By some fortunate process of reasoning he conceived while in Budapest (in 1882) that by using two or more out-of-phase alternating currents respectively passing through geometrically displaced coils it would be possible to develop his long sought progressively shifting magnetic field.

Lack of funds and facilities for working out his theory compelled still further postponement, but in 1885 Tesla had the good fortune to interest men of means in a direct current arc light which he had devised, and subsequently a laboratory was equipped for him in Liberty Street, New York, and here at last he found opportunity to demonstrate the correctness of his long cherished theory. In 1887 he was able to exhibit to his business associates and to Professor William A. Anthony, whose expert opinion they sought, motors having such progressively shifting



fields without the use of commutators, as he had foreseen nine years before.

Having thus demonstrated the correctness of his theory and the feasibility of its application, it remained for Tesla to work out various practical methods of applying the principle, and the rapidity and wonderful way in which he surrounded the entire field of constant speed, synchronous, induction and split-phase motors is beautifully set forth in his paper of May 18th, and in the numerous patents issued May 1st, 1888, and succeeding years, covering the forms of electric motors which have since become the almost universal means for transforming the energy of alternating currents into mechanical energy.

It is somewhat difficult to eliminate from our minds the developments of the past thirty years which have now become every day features of the electrical industry, and to realize the meagreness of the then existing knowledge of alternating current phenomena. The commercial use of alternating current systems of distribution was then scarcely two years old. The Gaulard & Gibbs system of series transformers had been used abroad in a limited way for a slightly longer period but the multiple arc system based upon the so-called "Stanley Rule" which initiated the great development of the present system, was not put in practical operation in the pioneer Great Barrington plant until March 1886. It was then recognized that while the alternating current possessed wonderful possibilities for electrical distribution for lighting purposes, two almost necessary devices were lacking to render it a complete success, one a meter, the other a power motor. Professor Elihu Thomson promptly devised a successful form of meter, the motive portion of which comprised a laminated field and armature, the coils of the latter being periodically close-circuited during revolution by a commutator. To fill the demand for a power motor, however, the most promising device then suggested was a series commutator motor with laminated field and armature cores, but no satisfactory results had been obtained. Such was the situation when Tesla's achievement was announced in the Institute paper to which reference has been made.

His Honor Judge Townsend of the United States Circuit Court, in an opinion rendered in August, 1900, as the outgrowth of some patent litigation on the Tesla inventions, concisely defines the underlying characteristic of the Tesla motor as follows:

"Tesla's invention, considered in its essence, was the production of a continuously rotating or whirling field of magnetic forces for power purposes by generating two or more displaced or differing phases of the alternating current, transmitting such phases, with their independence preserved, to the motor, and utilizing the displaced phases as such in the motor."

Among the first to recognize the immense importance of Mr. Tesla's motors were Mr. Westinghouse and his advisors, Mr. T. B. Kerr, Mr. Byllesby, Mr. Shallenberger and Mr. Schmid,



and in June Mr. Westinghouse secured an option which shortly resulted in the purchase of the patents, thus bringing under one ownership the alternating current transformer system of distribution, and the Tesla motor. It is interesting to here note that Mr. Shallenberger had about two weeks before the publication of the Tesla patents independently devised an alternating current meter, the principle of operation of which was that of the Tesla motor, and whatever might have been Mr. Shallenbergers's natural disappointment upon finding himself thus anticipated, he as once recognized that to Mr. Tesla belonged the honor of being the first to solve the great fundamental problem of an alternating current motor. A warm friendship between these two men began at once and continued throughout Mr. Shallenberger's life, and Mr. Tesla rejoiced to accord to Mr. Shallenberger full credit for the latter's brilliant work in producing what is now the standard meter for alternating currents.

As illustrating the generous gentleness of Tesla's character, I wish to here quote from testimony given by him in 1903. Referring to Shallenberger, Tesla said:

"I clearly remember that in the first days when I came to Pittsburgh he took me to lunch at the Duquesne Hotel, and when I told him that I was sorry that I had anticipated him, I saw tears in his eyes. That incident I remember vividly; but what has preceded it I cannot remember now. Perhaps it is because this impression was so vivid that it has destroyed the preceding ones, which were weaker."

It is characteristic of Tesla that he should so deeply regret the disappointments of another.

Owing in a measure to the circumstance that the then prevailing rate of alteration of the alternating current system was 16,000, the commercial introduction of Tesla motors was somewhat retarded during the first few years, that rate being found less adapted to the motor work than a lower rate. Today, however, wherever alternating current systems are used Tesla motors abound. Without such motors the alternating current system would have remained seriously restricted in its use.

Before passing to a consideration of other of Tesla's activities, it will be appropriate to refer again to the opinion of Judge Townsend, from which I quote the following:

"The Tesla discovery for which these patents were granted revolutionized the art of electrical power transmission, as well demonstrated in the record from both judicial and scientific standpoints."

In the closing passage of the opinion, Judge Townsend pays further tribute to Tesla in the following words:



"It remained to the genius of Tesla to capture the unruly, unrestrained, and hitherto opposing elements in the field of nature and art and to harness them to draw the machines of man. It was he who first showed how to transform the toy of Arago into an engine of power, the "Laboratory experiment" of Baily into a practically successful motor, the indicator into a driver. He first conceived the idea that the very impediments of reversal in direction, the contradictions of alternations, might be transformed into power-producing rotation, a whirling field of force.

What other looked upon as only invincible barriers, impassable currents, and contradictory forces, he brought under control and by harmonizing their directions taught how to utilize in practical motors in distant cities the power of Niagara."

Imagination developed to a high degree is a marked characteristic of all great inventors, so it is of our great poets, artists, philosophers, generals, and, in fact, of all great originators of thought and motion. The power to picture in the mind things not yet existent is an underlying characteristic of most great men. But imagination to be effective must be combined with a just sense of proportion, a logical appreciation of limitations, and a capacity for unremitting application. Mr. Tesla combines these qualities in a marked degree, and particularly does he possess the faculty of projecting his thought far into unexplored regions, not only of science but of philosophy. His passion for searching out the ultimate is charmingly evidenced by the following extract from his lecture before this Institute at Columbia College, May 20th, 1891;

"In how far we can understand the world around us is the ultimate thought of every student of nature. The coarseness of our senses prevents us from recognizing the ulterior construction of matter, and astronomy, this grandest and most positive of natural sciences, can only teach us something that happens, as it were, in our immediate neighborhood; of the remoter portions of the boundless universe, with its numberless stars and suns, we know nothing. But far beyond the limit of perception of our senses the spirit still can guide us, and so we may hope that even these unknown worlds - infinitely small and great - may in a measure become known to us. Still, even if this knowledge should reach us, the searching mind will find a barrier, perhaps forever unsurpassable, to the true recognition of that which seems to be, the mere appearance of which is the only and slender basis of all our philosophy.



Of all the forms of nature's immeasurable, all-pervading energy, which, over and over changing and moving, like a soul animates the inert universe, those of electricity and magnetism are perhaps the most fascinating."

The impress made upon the world by the deeds of a great inventor cannot be measured by the number of patents which he has received nor by the monetary reward secured not by the mere exploitation of his name. Often his greatest gifts are in the form of inspiring contributions to the literature, filled with suggestions of lines of thought which lead others to work in untried fields. This is especially true of a series of lectures delivered by Mr. Tesla upon the subject of high frequency, high potential currents. The first of the series was given at Columbia College in 1891, before this Institute. During 1892 and 1893 this lecture with additional data and experiments was repeated in London, Paris, Philadelphia and St. Louis.

Referring to an interesting interview with Mr. Tesla appearing in a New York daily in 1893 regarding the St. Louis lecture the Editor of the Electrical World says:

"Mr. Tesla, in his own graceful way, tells the story of his life and the history of some of his more important inventions. Perhaps there is no living scientist in whose life and work the general public takes a deeper interest, especially in this country."

Tesla's fundamental purpose was to publish the results of an extended research and of a series of experiments patiently conducted at his laboratory and elsewhere through many years. During these lectures he exhibited to the audience numerous experiments displaying striking and instructive phenomena. He also described many novel pieces of apparatus such, for instance, as his high-frequency generator and induction coils and his magnetically quenched arc. Mr. Erskine Murray in his treatise upon Wireless Telegraphy, referring to certain of these early inventions of Tesla says:

"Among many other inventions, made as early as 1893, perhaps the most important to wireless telegraphists is his method of producing long trains of waves of high frequency, and of transforming them to higher voltage. After several unsuccessful attempts he completed an alternator which could be run at 30,000 periods per second, and designed a form of transformer capable of transforming these currents to very high voltage. He also showed that his transformer, or "Tesla coil" as it is usually called nowadays, could transform currents of much higher frequencies than were obtainable from his alternator, even currents of 100,000 or 1,000,000 periods per second, such as are produced by the oscillatory discharge of a Leyden jar."



The London lecture was given under the auspices of the British Institution of Electrical Engineers and because of the intense public interest manifested after its announcement the ample capacity of the Theatre of the Royal Institution was required to accommodate the audience.

At the completion of the lecture Prof. Ayton spoke as follows:

"It is my most pleasing duty to propose a very hearty vote of thanks to our lecturer, who has entertained us, it is true, for two hours; but we would willingly wait for another hour's similar entertainment."

Mr. Fleming in his authoritative book on wireless telegraphy and telephony pays the following tribute:

"In 1892 Nikola Tesla captured the attention of the whole scientific world by his fascinating experiments on high frequency electric currents. He stimulated the scientific imagination of others as well as displayed his own, and created a widespread interest in his brilliant demonstrations.

Amongst those who witnessed these things no one was more able to appreciate their inner meaning than Sir William Crookes."

An article by E. Raverot appearing in the Electrical World of March 26, 1892, closes a review of the Tesla Paris lecture with the following appreciative comment:

"One sees from this lecture the deep interest which the works and discoveries of Mr. Tesla have inspired among physicists since the first appearance of his publication, and it is with great satisfaction that we are able to express the feeling of admiration which his experiments have inspired in us."

In his London lecture delivered in February 1892 Tesla had occasion to describe a special construction of insulated cable designed to guard against electro-static disturbances, but immediately added the following significant prediction:

"But such cables will not be constructed, for ere long intelligence - transmitted without wires - will throb through the earth like a pulse through a living organism. The wonder is that, with the present state of knowledge and experiences gained, no attempt is being made to disturb the electrostatic or magnetic condition of the earth and transmit, if nothing else, intelligence."

This was Tesla's prophecy twenty-five years ago.



In his lecture before the National Electric Light Association at St. Louis in March, 1893, Mr. Tesla elaborated certain views regarding the importance of resonance effects in this field and stated:

"I would say a few words on a subject which constantly fills my thoughts and which concerns the welfare of all. I mean the transmission of intelligible signals or perhaps even power to any distance without the use of wires."

He then announced that his conviction had grown so strong that he no longer looked upon the plan of transmitting intelligence as a mere theoretical possibility, and referring to the existing belief of some that telephony to any distance might be accomplished "by induction through the air", concisely set forth his theory as follows:

"I cannot stretch my imagination so far, but I do firmly believe that it is practical to disturb by means of powerful machines the electro-static condition of the earth and thus transmit intelligible signals and perhaps power."

Enlarging upon this theory, he states that, although we have no possible evidence of a charged body existing in space without other oppositely electrified bodies being near, there is a fair probability that the earth is such a body, for by whatever process it was separated from other bodies it must have retained a charge and that the upper strata of the air may be conducting and contain this opposite charge. He further expanded the theory that with proper means for producing electrical oscillations it might be possible to produce electrical disturbances sufficiently powerful to be perceptible by suitable instruments at any point on the Earth's surface. He thus forecast the theory at present accepted by leading scientists as the true basis of wireless telegraphy.

Continuing the same line of thought Mr. Tesla in an interview which appeared in the New York Herald in 1893 said:

"One result of my investigations, the possibility of which has been proven by experiment, is the transmission of energy through the air. I advanced that idea some time ago, and I am happy to say it is now receiving some attention from scientific men."

The plan I have suggested is to disturb by powerful machinery the electricity of the earth, thus setting it in vibration. Proper appliances will be constructed to take up the energy transmitted by these vibrations, transforming them into suitable form of power to be made available for the practical wants of life."



Testifying in a patent suit regarding these early predictions Mr. John Stone Stone, the well-known authority on wireless telegraphy has but recently made the following striking comment:

"I misunderstood Tesla. I think we all misunderstood Tesla. We thought he was a dreamer and visionary. He did dream and his dreams came true, he did have visions but they were of a real future, not an imaginary one. Tesla was the first man to lift his eyes high enough to see that the rarified stratum of atmosphere above our earth was destined to play an important role in the radio telegraphy of the future, a fact which had to obtrude itself on the attention of most of us before we saw it. But Tesla also perceived what many of us did not in those days, namely, the currents which flowed away from the base of the antenna over the surface of the earth and in the earth itself."

Seldom is it that an art springs into being through the efforts of one man alone, but rather as a growth to which many have contributed. This is peculiarly true of the wireless art, and without detracting in the slightest from the honor which is justly due to those who have brought the system to its present wonderful efficiency, it is just to accord to Tesla highest praise not alone for his exposition of principles as set forth in his lectures but also for the more definitive work which followed, much of which is evidenced by his many patents dealing with the wireless art.

Before leaving this branch of Tesla's work, I wish to quote again from the testimony of Mr. Stone, presenting his view of the indebtedness of the wireless art to Tesla:

"Some of those whose work or whose writings during that early period must be noted are, Nikola Tesla, Prof. Elihu Thomson, Prof. M. I. Pupin, Prof. Lodge, Prof. Northrup, Prof. Pierce, Hutin & Leblanc, Mr. Marconi and myself. Among all these, the name of Nikola Tesla stands out most prominently. Tesla, with his almost preternatural insight into alternating current phenomena that had enabled him some years before to revolutionize the art of electric power transmission through the invention of the rotary field motor, knew how to make resonance serve, not merely the role of microscope to make visible the electric oscillations, as Hertz had done, but he made it serve the role of a stereoptician to render spectacular to large audiences the phenomena of electric oscillations and high frequency currents.\*\*\*\*\* He did more to excite interest and create an intelligent understanding of these phenomena in the years 1891-92-93 than any one else, and the more we learn about high frequency phenomena, resonance and radiation today, the nearer we find ourselves approaching what we at one time were inclined, through a species of intellectual myopia, to



regard as the fascinating but fantastical speculations of a man who we are now compelled, in the light of modern experience and knowledge, to admit was a prophet. He saw to the fulfillment of his prophesies and it has been difficult to make any but unimportant improvements in the art of radio-telegraph without traveling part of the way at least, along a trail blazed by this pioneer who, though eminently ingenious, practical and successful in the apparatus he devised and constructed, was so far ahead of his time that the best of us then mistook him for a dreamer."

Another well recognized wireless authority, Professor Slaby in a personal letter to Tesla took occasion to say:

"I am devoting myself since some time to investigations in wireless telegraph, which you have first founded in such a clear and precise manner. It will interest you, as father of this telegraph, to know, etc."

Throughout Tesla's work with high potential currents he had persistently in mind the wireless transmission of power in large quantities. It was in the furtherance of this line of investigation that he expended large amounts of money and years of labor at Wardenclyffe, Long Island, and at Telluride, Colorado. Late in 1914 he secured a patent upon an application filed twelve years before upon an apparatus for transmitting electric energy with which he hopes to be able to transmit unlimited power with high economy to any distance without wires. While as yet these efforts have not resulted in commercial exploitation, the future may prove that his dream of thus transmitting energy in substantial amounts is of that class which is time come true, as in the case of his dream of wireless telegraphy.

Another use to which Tesla adapted the results of his high frequency investigations was the control of the movements of torpedoes and boats. In 1898 he patented such an apparatus and also built and successfully operated such a craft. The movements of the propelling engine, the steering and other mechanisms were controlled wirelessly from the shore or other point through a distance of two miles. Apparently this, like some of his other inventions, was ahead of its time. Tesla, however, evidenced his entire faith in the future of the apparatus in an interview which appeared in 1898 from which I quote:

"But I have no desire that my fame should rest on the invention of a merely destructive device, no matter how terrible. I prefer to be remembered as the inventor who succeeded in abolishing war. That will be my highest pride. But there are many peaceful uses to which my invention can be put, conspicuously that of rescuing the shipwrecked.

It will be perfectly feasible to equip our lifesaving stations with life cars, or life boats, directed and controlled from the shores, which will approach stranded vessels and bring off the passengers and crews without risking the lives of the brave fel-



lows who are now forced to fight their way to the rescue through the raging surf. It may also be used for the propulsion of pilot boats, for carrying letters or provisions or instruments to inaccessible regions\*\*\*\*".

On March 12th, 1895 Mr. Tesla met with a disastrous loss by the destruction of his laboratory at 33 and 35 South 5th Avenue, New York. In the Electrical Review of March 20th, 1895, there is published an interview with Mr. Tesla regarding this fire. In it he says:

"I am congratulating myself all the time it is no worse. I begin all over again, but I have the knowledge and experience of what has gone before, and fortunately I was able to show with completed apparatus that my ideas and theories are correct. Had the fire occurred a few months ago I should have been robbed of the opportunity of many highly successful demonstrations."

In his laboratory were stored a vast quantity of old models and trial apparatus with which he would have been unwilling to part for any amount of money. He further states that he was at the time engaged upon four main lines of work and investigation: his oscillator, an improved method of electric lighting, the transmission of intelligence without wires, and, an investigation relating to the nature of electricity. Mr. Tesla deeply appreciated the expressions of sympathy received from his many friends and with unabated zeal applied himself to a continuation of the work thus unfortunately interrupted.

Another field of investigation in which Mr. Tesla has contributed valuable material is related to the Roentgen Ray. In the Electrical Review of March and April 1896, there appeared a number of communications from Mr. Tesla which while giving full credit to Roentgen for his magnificent discovery make public much additional data derived from his own careful experiments in this line of research. From an editorial in the Electrical Review of March 18th, 1896, the following is quoted:

"The announcement of Nikola Tesla's achievements in the new art first published in the Electrical Review of March 11th, in the authors own modest language has added fresh impetus to the work in this direction. His disruptive discharge coil has been universally used where the best results in radiography have been obtained, and his two marked improvements, namely, the single electrode tube and his method of rarefaction, promise great results. Other important points about Tesla's work are the fine details he has obtained in his radiographs, the great distance at which the radiographs have been made, and brief time of exposure."

and again:

"Mr. Tesla is pursuing quietly his work and giving all credit to Roentgen; and it is significant, we think, that the first radiograph he produced in his laboratory was the name of the discoverer. We



wish that such courtesies among scientists would always be practiced."

Mr. J. Mount Bleyer commenting upon these investigations said:

"The results obtained by Tesla are simply marvelous, but are just what I expected."

Among the many other inventions to which Mr. Tesla has devoted much time and energy may be mentioned a thermo-magnetic motor and a pyro-magnetic generator, anti-sparking dynamo brush and commutator, auxiliary brush regulation of direct current dynamos, uni-polar dynamos, mechanical and electrical oscillators, electro-therapeutic apparatus, the oxidation of nitrogen by high frequency currents, and an electrolytic registering meter. The last named device was based upon an exceedingly interesting theory. The current to be measured was passed through two parallel conductors arranged in series. The current established a difference of potential between these conductors proportional to the strength of the current passing. This results in a transference of the metal from one conductor to the other, thereby decreasing the resistance of one and increasing that of the other. From such variations in resistance of one or both, the current energy expended is computed.

One other line of endeavor entirely outside of electricity to which Tesla has given much attention is the development of a bladeless steam turbine in which the friction of the passing steam as distinguished from its direct impact is availed of. The steam is admitted between plain parallel rotating discs and passing spirally from the circumference toward the axial center imparts energy to the discs. Such a turbine can be run at exceedingly high temperatures, is readily reversible and having no blades is extremely simple and free from liability to accidental derangement. With great ingenuity Tesla has succeeded in producing such machines of considerable power and having exceedingly interesting characteristics. It is to be hoped that with his indefatigable zeal Tesla will soon succeed in perfecting the commercial application of this invention.

It is not possible in this brief survey even to touch upon many of the lines of Mr. Tesla's activities, but we must content ourselves with this inadequate presentation of typical evidences of the fascinating genius of this man whom we delight to welcome as a citizen of our country - the country which he twenty-five years ago adopted as his own - the country of which he once said:

"When I arrived upon your hospitable shores I eagerly applied myself to work and to learn, and I have persevered in that course. If I have made any special success in this country, I attribute it largely to a feature which is characteristic of both the English and American races; that is, their keen and generous appreciation of any work that they think is good."

Mr. Tesla, we would indeed be woefully lacking in the attributes which you so kindly ascribe to us are we not most cordially appreciative of your work, work which we know is good.



THE PRESIDENT: Gentlemen, we are fortunate in having with us to-night another man who has been familiar with Mr. Tesla's work for many years and can tell us something further about his work. I introduce Mr. B. A. Behrend.

B. A. BEHREND: Mr. Chairman: Mr. President of the American Institute of Electrical Engineers: Fellow Members: Ladies and Gentlemen:

BY AN EXTRAORDINARY COINCIDENCE, it is exactly twenty-nine years ago, to the very day and hour, that there stood before this Institute Mr. Nikola Tesla, and he read the following sentences:

"To obtain a rotary effort in these motors was the subject of long thought. In order to secure this result it was necessary to make such a disposition that while the poles of one element of the motor are shifted by the alternate currents of the source, the poles produced upon the other elements should always be maintained in the proper relation to the former, irrespective of the speed of the motor. Such a condition exists in a continuous current motor; but in a synchronous motor, such as described, the condition is fulfilled only when the speed is normal.

"The object has been attained by placing within the ring properly subdivided cylindrical iron core wound with several independent coils closed upon themselves. Two coils at right angles are sufficient, but a greater number may be advantageously employed. It results from this disposition that when the poles of the ring are shifted, currents are generated in the closed armature coils. These currents are the most intense at or near the points of the greatest density of the lines of force, and their effect is to produce poles upon the armature at right angles to those of the ring, at least theoretically so; and since this action is entirely independent of the speed - that is, as far as the location of the poles is concerned - a continuous pull is exerted upon the periphery of the armature. In many respect these motors are similar to the continuous current motors. If load is put on, the speed, and also the resistance of the motor, is diminished and more current is made to pass through the energizing coils, thus increasing the effort. Upon the load being taken off, the counter-electromotive force increases and less current passes through the primary or energizing coils. Without any load the speed is very nearly equal to that of the shifting poles of the field magnet.

"It will be found that the rotary effort in these motors fully equals that of the continuous current motors. The effort seems to be greatest when both armature and field magnet are without any projections."



Not since the appearance of Faraday's Experimental Researches in Electricity has a great experiment truth been voiced so simply and so clearly as this description of Mr. Tesla's great discovery of the generation and utilization of polyphase alternating currents. He left nothing to be done for those who followed him. His paper contained the skeleton even of the mathematical theory.

Three years later, in 1891, there was given the first great demonstration, by Swiss engineers, of the transmission of power at 30,000 volts from Laufen to Frankfurt by means of Mr. Tesla's system. A few years later this was followed by the development of the Cataract Construction Company, under the presidency of our member, Mr. Edward D. Adams, and with the aid of the engineers of the Westinghouse Company. It is interesting to recall here to-night that in Lord Kelvin's report to Mr. Adams, Lord Kelvin recommended the use of direct current for the development of power at Niagara Falls and for the transmission to Buffalo.

The due appreciation or even enumeration of the results of Mr. Tesla's invention is neither practicable nor desirable at this moment. There is a time for all things. - Suffice it to say that, were we to seize and to eliminate from our industrial world the results of Mr. Tesla's work, the wheels of industry would cease to turn, our electric cars and trains would stop, our towns would be dark, our mills would be dead and idle. Yea, so far reaching is this work, that it has become the warp and woof of industry.

The basis for the theory of the operating characteristics of Mr. Tesla's rotating field induction motor, so necessary to its practical development, was laid by the brilliant French savant, Prof. Andre Blondel, and by Prof. Kapp of Birmingham. It fell to my lot to complete their work and to coordinate, - by means of the simple "circle diagram," - the somewhat mysterious and complex experimental phenomena. As this was done twenty-one years ago, it is particularly pleasing to me, upon the coming of age of this now universally accepted theory, - tried out by application to several million horse power of machines operating in our great industries, - to pay my tribute to the inventor of the motor and the system which have made possible the electric transmission of energy. HIS name marks an epoch in the advance of electrical science. From THAT work has sprung a revolution in the electrical art.

We asked Mr. Tesla to accept this medal. We did not do this for the mere sake of conferring a distinction, or of perpetuating a name; for so long as men occupy themselves with our industry, his work will be incorporated in the common thought of our art, and the name of Tesla runs no more risk of oblivion than does that of Faraday, or that of Edison.

Nor indeed does this Institute give this medal as evidence that Mr. Tesla's work has received its official sanction. His work stands in no need of such sanction.



No, Mr. Tesla, we beg you to cherish this medal as a symbol of our gratitude for the new creative thought, the powerful impetus, akin to revolution, which you have given to our art and to our science. You have lived to see the work of your genius established. What shall a man desire more than this? There rings out to us a paraphrase of Pope's lines on Newton:

Nature and Nature's laws lay hid in night  
God said, 'Let Tesla be,' and all was light.

THE PRESIDENT: It is easy, I think, for engineers and scientists to take for granted things that have been done in years past. When we sit under an apple tree and see the apples fall, it is an obvious phenomenon of nature. We can understand the laws of gravitation, but to Sir Isaac Newton, many years ago, this phenomenon, which to us to-day is so simple, helped him to an act of creative imagination of the most extraordinary kind.

...So, later on, the phenomenon of electromagnetic induction, which to us to-day has become a matter of second nature, to Faraday was an act of the most extraordinary creative imagination.

Thirty years ago when Mr. Tesla was doing his very great work, we sometimes forget the conditions of electrical engineering which prevailed at that time. Direct-current or continuous current was universally used, and the conceptions of electrical engineers with respect to electric currents were all unidirectional, so to speak. We had not arrived at that conception of currents which went first in one direction and then in another, to say nothing of electrical currents which differed by phase relations, and the work of Nikola Tesla at that time in his great conception of the rotary field seems to me one of the greatest feats of imagination which has ever been attained by human mind. To-day we take the rotary field motor, the rotary field transmission, as a matter of course, because we have become used to it, and we forget what it required of the human intellect to create it thirty or thirty-five years ago.

At the time the great Niagara Falls enterprise was instituted, we were under the direct-current regime. As Mr. Behrend says, such a great authority on electrical engineering as Lord Kelvin, and also Mr. Edison, recommended direct-current for transmission of energy from Niagara Falls to Buffalo, and as a system for universal use in their great waterpower development. I think we all realize to-day where we should be at the present time if direct-current had been used in the development of that enterprise. There would have been a radiating copper mine running out from Niagara Falls which would have wrecked the enterprise in the first year of its existence. Mr. Tesla came along with his great mind and at the psychological moment devised the principle which made that enterprise a success, and made hundreds of other enterprises all over the world an equal success. We owe him the greatest possible debt of gratitude for what he has done for electrical engineers.

And so again, in another field of endeavor in which he was most conspicuous, that of high voltage and high frequency alternating-current, he devised and discovered phenomena which were entirely new to electrical engineers, and he introduced to the world the conception of alternating-current as being elastic.



or oscillating media. The direct-current engineers at the time never thought of the electric current being something that could oscillate, and Mr. Tesla showed it could, and he also showed many of the phenomena which resulted from oscillating currents. From his work followed the great work of Roentgen, who discovered the Roentgen rays, and all that work which has been carried on throughout the world in following years by J. J. Thompson and others; which has really led to the conception of modern physics. His work, as has been stated, antedated that of Marconi and formed the basis of wireless telegraphy, which is one of the most scientific applications of the present day, and so on throughout all branches of science and engineering we find from time to time some important evidence of what Tesla has contributed to the sciences and engineering of the present day. So, Mr. Tesla, you hear to-night the many compliments which have been paid to you, but they are not bouquets merely cast for the adornment of the occasion - they have been given with the sincere appreciation of the electrical profession, and we give this medal to you in recognition of this, with full appreciation of what you have done for us, and with great hope that you may continue to contribute to our profession in the future. (Great applause)

NIKOLA TESLA: Mr. President, Ladies and Gentlemen. - I wish to thank you heartily for your kind sympathy and appreciation. I am not deceiving myself in the fact, of which you must be aware, that the speakers have greatly magnified my modest achievements. One should in such a situation be neither diffident nor self-assertive, and in that sense I will concede that some measure of credit may be due to me for the first steps in certain new directions; but the ideas I advanced have triumphed, the forces and elements have been conquered, and greatness achieved, through the co-operation of many able men some of whom, I am glad to say, are present this evening. Inventors, engineers, designers, manufacturers and financiers have done their share until, as Mr. Behrend said, a gigantic revolution had been wrought in the transmission and transformation of energy. While we are elated over the results achieved we are pressing on, inspired with the hope and conviction that this is just a beginning, a forerunner of further and still greater accomplishments.

On this occasion, you might want me to say something of a personal and more intimate character bearing on my work. One of the speakers suggested: "Tell us something about yourself, about your early struggles." If I am not mistaken in this surmise I will, with your approval, dwell briefly on this rather delicate subject.

Some of you who have been impressed by what has been said, and would be disposed to accord me more than I have deserved, might be mystified and wonder how so much as Mr. Terry has outlined could have been done by a man as manifestly young as myself. Permit me to explain this. I do not speak often in public, and wish to address just a few remarks directly to the members of my profession, so that there will be no mistake in the future. In the first place, I come from a very wiry and long-lived race. Some of my ancestors have been centenarians, and one of them lived one hundred and twenty-nine years. I am determined to keep up the record and please myself with prospects of great promise. Then again, nature has given me a vivid imagination which, through incessant exercise and



training, study of scientific subjects and verification of theories through experiment, has become very accurate and precise, so that I have been able to dispense, to a large extent, with the slow, laborious, wasteful and expensive process of practical development of the ideas I conceive. It has made it possible for me to explore extended fields with great rapidity and get results with the least expenditure of vital energy. By this means I have it in my power to picture the objects of my desires in forms real and tangible and so rid myself of that morbid craving for perishable possessions to which so many succumb. I may say, also, that I am deeply religious at heart, although not in the orthodox meaning, and that I give myself to the constant enjoyment of believing that the greatest mysteries of our being are still to be fathomed and that, all the evidence of the senses and the teachings of exact and dry sciences to the contrary notwithstanding, death itself may not be the termination of the wonderful metamorphoses we witness. In this way I have managed to maintain an undisturbed peace of mind, to make myself proof against adversity, and to achieve contentment and happiness to a point of extracting some satisfaction even from the darker side of life, the trials and tribulations of existence. I have fame and untold wealth, more than this, and yet - how many articles have been written in which I was declared to be an impractical unsuccessful man, and how many poor, struggling writers, have called me a visionary. Such is the folly and shortsightedness of the world!

Now, that I have explained why I have preferred my work to the attainment of worldly rewards, I will touch upon a subject which will lend me to say something of greater importance and enable me to explain how I invent and develop ideas. But first I must say a few words regarding my life which was most extraordinary and wonderful in its varied impressions and incidents. In the first place, it was charmed. - You have heard that one of the provisions of the Edison Medal was that the recipient should be alive. Of course the men who have received this medal have fully deserved it, in that respect, because they were alive when it was conferred upon them, but none has deserved it in anything like the measure I do, when it comes to that feature. In my youth my ignorance and lightheartedness brought me into innumerable difficulties, dangers and scrapes, from which I extricated myself as by enchantment. That occasioned my parents great concern more, perhaps, because I was the last male than because I was of their own flesh and blood. You should know that Serbians desperately cling to the preservation of the race. I was nearly drowned a dozen times. I was almost cremated three or four times and just missed being boiled alive. I was buried, abandoned and frozen. I have had narrow escapes from mad dogs, hogs and other wild animals. I have passed through dreadful diseases - have been given up by physicians three or four times in my life for good. I have met with all sorts of odd accidents - I cannot think of anything that did not happen to me, and to realize that I am here this evening, hale and hearty, young in mind and body, with all these fruitful years behind me, is little short of a miracle.

But my life was wonderful in another respect - in my capacity of inventor. Not so much, perhaps, in concentrated mentality, or physical endurance and energy; for these are common enough. If you



inquire into the career of successful men in the inventor's profession you will find, as a rule, that they are as remarkable for their physical as for their mental performance. I know that when I worked with Edison, after all of his assistants had been exhausted, he said to me: "I never saw such a thing, you take the cake." That was a characteristic way for him to express what I did. He worked from half past ten in the morning until five o'clock the next morning. I carried this on for nine months without a single day's exception; everybody else gave up. Edison stuck, but he occasionally dozed off on the table. What I wish to say particularly is that my early life was really extraordinary in certain experiences which led to everything I ever did afterwards. It is important that this should be explained to you as otherwise you would not know how I discovered the rotating field. From childhood I was afflicted in a singular way - I would see images of objects and scenes with a strong display of light and of much greater vividness than those I had observed before. They were always images of objects and scenes I had actually seen, never of such as I imagined. I have asked students of psychology, physiology and other experts about it, but none of them has been able to explain the phenomena which seems to have been unique, although I was probably predisposed, because my brother also saw images in the same way. My theory is that they were simply reflex actions from the brain on the retina, superinduced by hyper-excitation of the nerves. You might think that I had hallucinations. That is impossible. They are produced only in diseased and anguished brains. My head was always clear as a bell, and I had no fear. Do you want me to tell of my recollections bearing on this? (Turning to the gentlemen on the platform). This is traditional with me, for I was too young to remember anything of what I said. I had two old aunts, I recall, with wrinkled faces, one of them with two great protruding teeth which she used to bury into my cheek when she kissed me. One day they asked me which of the two was prettier. After looking them over I answered: "This one is not as ugly as the other one." That was evidence of good sense. Now as I told you, I had no fear. They used to ask me, "Are you afraid of robbers?" and I would reply "No". "Of wolves?" "No". Then they would ask, "Are you afraid of crazy Luka?" (A fellow who would tear through the village and nothing could stop him) "No, I am not afraid of Luka." "Are you afraid of the gander?" "Yes, I am," I would reply and cling to my mother. That was because once they put me in the court yard with - nothing on, and that beast ran up and grabbed me by the soft part of the stomach tearing off a piece of flesh. I still have the mark.

These images I saw caused me considerable discomfort. I will give you an illustration: Suppose I had witnessed a funeral. In my country the rites are but intensified torture. They smother the dead body with kisses, then they bathe it, expose it for three days, and finally one hears the dull thuds of the earth, when all is over. Some of the pictures as that of the coffin, for instance, would not only appear vividly but were sometimes so persistent that when I would stretch my hand out I would see it penetrate the image. As I look at it now these images were simply reflex actions through the optic nerve on the retina, producing on the same an effect identical to that of a projection through the lens, and if my view is



correct, then it will be possible, (and certainly my experience has demonstrated that), to project the image of any object one conceives in thought on a screen and make it visible. If this could be done it would revolutionize all human relations. I am convinced that it can and will be accomplished.

In order to free myself of these tormenting appearances, I tried to fix my mind on some other picture or image which I had seen, and in this way I would manage to get some relief; but in order to get this relief I had to let the images come one after the other very fast. Then I found that I soon exhausted all I had at my command, my "reel" was out, as it were. I had seen little of the world, only objects around my own home, and they took me a few times to some neighbors, that was all I knew. When I did so the second or third time, in order to chase the appearance from my vision, I found that this remedy lost all the force. When I began to make excursions beyond the limits of the little world I knew, and I saw new scenes. These were at first very blurred and indistinct, and would flit away when I tried to concentrate my attention upon them, but by and by I succeeded in fixing them; they gained in force and distinctness and finally assumed the intensity of real things. Soon I observed that my best comfort was attained if I simply went on in my vision farther and farther, getting new impressions all the time, and so I started to travel - of course, in my mind. You know that there have been great discoveries made - when Columbus found America that was one, but when I hit upon the idea of traveling it seemed to me that was the greatest discovery possible to man. Every night (and sometimes during the day), as soon as I was alone I would start on my travels. I would see new places, cities and countries, I would live there, meet people and make friendships and acquaintances, and these were just as dear to me as those in real life and not a bit less intense. That is the way I did until I reached almost manhood. When I turned by thoughts to invention, I found that I could visualize my conceptions with the greatest facility. I did not need any models, drawings or experiments, I could do it all in my mind, and I did. In this way I have unconsciously evolved what I consider a new method of materializing inventive concepts and ideas, which is exactly opposite to the purely experimental of which undoubtedly Edison is the greatest and most successful exponent. The moment you construct a device to carry into practice a crude idea you will find yourself inevitable engrossed with the details and defects of the apparatus. As you go on improving and reconstructing, your force of concentration diminishes and you lose sight of the great underlying principle. You obtain results, but at the sacrifice of quality. My method is different, I do not rush into constructive work. When I get an idea, I start right away to build it up in my mind. I change the structure, I make improvements, I experiment, I run the device in my mind. It is absolutely the same to me whether I operate my turbine in thought or test it actually in my shop. It makes no difference, the results are the same. In this way, you see, I can rapidly develop and perfect an invention, without touching anything. When I have gone so far that I have put into the device every possible improvement I can think of, that I can see no fault anywhere, I then construct this final product of my brain. Every time my device works as I conceive it should and my experiment comes out exactly as I plan it. In twenty years there has not been a single solitary experiment which did not turn out precisely as I thought it would. Why should it not? Engineering, electrical



and mechanical, is positive in results. Almost any subject presented can be mathematically treated and the effects calculated; but if it is such that results cannot be had by simple methods of mathematics or short cuts, there is all the experience, and all the data on which to draw and from which to build; - why, then, should one carry out the crude idea? It is not necessary, it is a waste of energy, money and time. Now, that is just the way I produced the rotating field.

If I am to give you in a few words the history of that invention, I must begin with my birthday, and you will see the reason why. I was born exactly at midnight, I have no birthday and I never celebrate it. But something else must have happened on that date. I have learned that my heart beat on the right side and did so for many years after. As I grew up it beat on both sides, and finally settled on the left. I remember that I was surprised, when I developed into a very strong man, to find my heart on the left side. Nobody understands how it happened. I had two or three falls and on one occasion nearly all my chest bones were crushed in. Something that was quite unusual must have occurred at my birth and my parents destined me for the clergy then and there. When I was six years old I managed to have myself imprisoned in a little chapel at an inaccessible mountain, and visited only once a year. It was a place of many bloody encounters and there was a grave yard near by. I was locked in there while looking for some sparrows' nests, and had the most dreadful night I ever passed in my life, in company with the ghosts of the dead. American boys will not understand it, of course, for there are no ghosts in America - the people are too sensible; but my country was full of them, and every one from the small boy up to the greatest hero, who was plastered all over with medals for courage and bravery, had a fear of ghosts. Finally, as by a wonder, they rescued me, and then my parents said: "Surely he must go to the clergy, he must become a churchman." Whatever happened after that, no matter what it was, simply fortified them in that resolution. One day, to tell you a little story, I fell from the top of one of the farm buildings into a large kettle of milk, which was boiling over a roaring fire. Did I say boiling milk? - It was not boiling - not according to the thermometer - though I would have sworn it was when I fell into it, and they pulled me out. But I only got a blister on the knee where I struck the hot kettle. My parents said again: "Was not that wonderful? Did you ever hear of such a thing? he will surely be a bishop, a metropolitan, perhaps a patriarch." In my eighteenth year I came to the cross roads. I had passed through the preliminary schools and had to make up my mind either to embrace the clergy or to run away. I had a profound respect for my parents, and so I resigned myself to take up studies for the clergy. Just then one thing occurred, and if it had not been for that, I would not have had my name connected with the occasion of this evening. A tremendous epidemic of cholera broke out, which decimated the population and, of course, I got immediately. Later it developed into dropsy, pulmonary trouble, and all sorts of diseases until finally my coffin was ordered. In one of the fainting spells when they thought I was dying, my father came to my bedside and cheered me: "You are going to get well." "Perhaps," I replied, "if you will let me study engineering." "Certainly I will," he assure me, "you will go to the best polytechnic school in Europe." I recovered to the amazement of everybody. My father



kept his word, and after a year of roaming through the mountains and getting myself in good physical shape, I went to the Polytechnic School at Gratz, Styria, one of the oldest institutions. Something else occurred, however, of which I must tell you as it is vitally linked with this discovery. In the preparatory schools there was no liberty in the choice of subjects, and unless a student was proficient in all of them he could not pass. I found myself in this predicament every year. I could not draw. My faculty for imagining things paralyzed whatever gift I might have had in this respect. I have made some mechanical drawings, of course; practicing so many years one must needs learn to make simple sketches, but if I draw for half an hour I am all exhausted. I never was qualified and passed only through my father's influence. Now, when I went to the polytechnic school I had free choice of subjects and proposed myself to show my parents what I could do. The first year on the polytechnic school was spent in this way - I got up at three o'clock in the morning and worked until eleven o'clock at night, for one whole year, with a single day's exception. Well, you know when a man with a reasonable healthy brain works that way he must accomplish something. Naturally, I did. I graduated nine times that year and some of the professors were not satisfied with giving me the highest distinction, because they said, that did not express their idea of what I did, and here is where I come to the rotating field. In addition to the regular graduating papers they gave me some certificates which I brought to my father believing that I had achieved a great triumph. He took the certificates and threw them into the waste basket, remarking contemptuously: "I know how these testimonials are obtained." That almost killed my ambition; but later, after my father had died, I was mortified to find a package of letters, from which I could see that there had been considerable correspondence going on between him and the professors who had written to the effect that unless he took me away from school I would kill myself with work. Then I understood why he had slighted my success, which I was told was greater than any previous one at that institution; in fact the best students had only graduated twice. My record in the first year had the result that the professors became very much interested in and attached to me, particularly three of them; Prof. Rogner who was teaching arithmetical subjects and geometry; Prof. Aille, one of the most brilliant and wonderful lecturers I have ever seen, who specialized in differential equations, about which he wrote quite a number of works in German, and Prof. Foeschl, who was my instructor in physics. These three men were simply in love with me and used to give me problems to solve. Prof. Foeschl was a curious man. I never saw such feet in my life. They were about that size. (Indicating) His hands were like paws, but when he performed experiments they were so convincing and the whole went off so beautifully that one never realized now they were gone. It was all in the method. He did all with the precision of a clock work, and everything succeeded.

It was in the second year of my studies that we received a Gramme machine from Paris, having a horse-shoe for of laminated magnet, and a wound armature with a commutator. We connected it up and showed various effects of currents. During the time Prof. Foeschl was making demonstrations running the machine as motor we had some trouble with the brushes. They sparked very badly, and I observed: "Why should not we operate with the brushes?" Prof. Foeschl declared that it could not be done, and in view of my success in the past year he did me the honor of delivering a lecture touching on



the subject. He remarked: "Mr. Tesla may accomplish great things, but he certainly never will do this," and he reasoned that it would be equivalent to converting a steadily pulling force, like that of gravity, into a rotary effort, a sort of perpetual motion scheme, an impossible idea. But you know that instinct is something which transcends knowledge. We have, undoubtedly certain finer fibers that enable us to perceive truths when logical deduction, or any other willful effort of the brain, is futile. We cannot reach beyond certain limits in our reasoning, but with instinct we can go to very great lengths. I was convinced that I was right and that it was possible. It was not a perpetual motion idea, it could be done, and I started to work at once.

I will not tire you with an extended account of this undertaking, but will only say that I began in the summer of 1877 and I proceeded as follows: I would picture, first of all, a direct-current machine, run it and see how the currents changed in the armature. Then I would imagine an alternator and do the same thing. Next I would visualize systems comprising motors and generators, and so on. Whatever apparatus I imagined, I would put together and operate in my mind, and I continued this practice incessantly until 1882. In that year somehow or other, I began to feel that a revelation was near. I could not yet see just exactly how to do it, but I know that I was approaching the solution. While on my vacation, in 1882, sure enough, the idea came to me and I will never forget the moment. I was walking with a friend of mine in the city park of Budapest reciting passages from Faust. It was nothing for me to read from memory the contents of an entire book, with every word between the covers, from the first to the last. My sister and brother, however, could do much better than myself. I would like to know whether any of you has that kind of a memory. It is curious, entirely visual and retroactive. To be explicit - when I made my exams, I had always to read the books three or four days if not a week before, because in that time I could reconstruct the images and visualize them: but if I had an examination the next day after reading, images were not clear and the remembrance was not quite complete. As I say, I was reciting Goethe's poem, and just as the sun was setting I felt wonderfully elated, and the idea came to me like a flash. I saw the whole machinery clearly, the generator, the motor, the connections, I saw it work as if it had been real. With a stick I drew on the sand the diagrams which were shown in my paper before the American Institute of Electrical Engineers and illustrated in my patents, as clearly as possible, and from that time on I carried this image in my mind. Had I been a man possessed of the practical gifts of Edison, I would have gone right away to perform an experiment and push the invention along, but I did not have to do this. I could see pictures so vividly, and what I imagined was so real and palpable, that I did not need any experimenting, nor would it have been particularly interesting to me. I went on and improved the plan continuously, inventing new types, and the day I came to America, practically every form, every kind of construction, every arrangement of apparatus I described in my thirty or forty patents was perfected, except just two or three kinds of motors which were the result of later development.



In 1823, I made some tests in Strasburg, as Mr. Terry pointed out, and there at the railroad station obtained the first rotation. The same experiment was repeated twice.

Now I come to an interesting chapter of my life, when I arrived in America. I had made some improvements in dynamos for a French company who were getting their machinery from here. The improved forms were so much better that the manager of the works said to me: "You must go to America, and design the machines for the Edison Company." So, after ineffectual efforts on the other side to get somebody to interest himself in my plans financially, I came to this country. I wish that I could only give you an idea how what I saw here impressed me. You would be very much astonished. You have all undoubtedly read those charming Arabian Nights tales, in which the genii transports people into wonderful regions, to go through all sorts of delightful adventures. My case was just the opposite. The genii transported me from a world of dreams into one of realities. My world was beautiful, ethereal, as I could imagine it. The one I found here was a machine world; the contact was rough, but I liked it. I realized from the very moment I saw Castle Garden that I was a good American before I landed. Then came another event. I met Edison, and the effect he produced upon me was extraordinary. When I saw this wonderful man, who had had no theoretical training at all, no advantages, who did all himself, getting great results by virtue of his industry and application, I felt mortified that I had squandered my life. I had studied a dozen languages, delved in literature and art and had spent my best years in ruminating through libraries and reading all sorts of stuff that fell into my hands. I thought to myself, what a terrible thing it was to have wasted my life in those useless efforts. If I had only come to America earlier and devoted all of my brain power to inventive work, what might I have done? In later life though, I realized I would not have produced anything without the scientific training I got, and it is a question whether my surmise as to my possible accomplishment was correct. In Edison's works I passed nearly a year of the most strenuous labor, and then certain capitalists approached me with the project to form my own company. I went into the proposition, and developed an arc light. To show you how prejudiced people were against the alternating-current, as the President has indicated, when I told these friends of mine that I had a great invention relating to alternating-current transmission, they said: "No, we want the arc lamp. We do not care for this alternating-current." Finally I perfected my lighting system and the city adopted it. Then I succeeded in organizing another company, in April, 1886, and a laboratory was put up, where I rapidly developed these motors, and eventually the Westinghouse people approached us, and an arrangement was made for their introduction. You know what has happened since then. The invention has swept the world.

I should like to say just a few words regarding the Niagara Falls enterprise. We have a man here ton-night to whom belongs really the credit for the early steps and for the first financiering of the project, which was difficult at that time. I refer to Mr. E. D. Adams. When I heard that such authorities as Lord Kelvin and Prof. W. C. Unwin had recommended - one the direct-current system and the other compressed air - for the transmission of power from Niagara Falls to Buffalo, I thought it was dangerous to let the matter go further, and I went to see Mr. Adams. I remember the inter-



view perfectly. Mr. Adams was much impressed with what I told him. We had some correspondence afterwards, and whether it was in consequence of my enlightening him on the situation, or owing to some other influence, my system was adopted. Since that time, of course, new men, new interests have come in, and what has been done I do not know, except that the Niagara Falls enterprise was the real starting impulse in the great movement inaugurated for the transmission and transformation of energy on a huge scale.

Mr. Terry has referred to other inventions of mine. I will just make a few remarks relative to these as some of my work has been misunderstood. It seems to me that I ought to tell you a few words about an effort that absorbed my attention later. In 1892 I delivered a lecture at the Royal Institution and Lord Rayleigh surprised me by acknowledging my work in very generous terms, something that is not customary, and among other things he stated that I had really an extraordinary gift for invention. Up to that time, I can assure you, I had hardly realized that I was an inventor at all. I looked upon the so-called field discovery as simply a mathematical, logical, step by step deduction. I arrived at this invention by sheer force or energy, by using screws and levers, as it were. I did not get an inspiration, it seemed to me. My machines were fully developed in my mind. When I tried the first experiments they meant nothing to me. I had already demonstrated them perfectly. So, when I went home, in 1892, and read these remarks of Lord Rayleigh, I began to think and convinced myself that I was an inventor. I remembered, for instance, when I was a boy, I could go out into the forest and catch as many crows as I wanted, and nobody else could do it. Once, when I was seven years of age, I repaired a fire engine which the engineers could not make work, and they carried me in triumph through the city. I constructed turbines, clocks and such devices as no other boy in the community. I said to myself: "If I really have a gift for invention, I will bend it to some great purpose or task and not squander my efforts on small things." Then I began to ponder just what was the greatest deed to accomplish. One day as I was walking in the forest a storm gathered and I ran under a tree for shelter. The air was very heavy, and all at once there was a lightning flash, and immediately after a torrent of rain fell. That gave me the first idea. I realized that the sun was lifting the water vapor, the wind swept it over the regions where it accumulated and reached a condition when it was easily condensed and fell to earth again. This life-sustaining stream of water was entirely maintained by sun power, and lightning, or some other agency of this kind, simply came in as a trigger-mechanism to release the energy at the proper moment. I started out and attacked the problem of constructing a machine which would enable us to precipitate this water whenever and wherever desired. If this was possible, then we could draw unlimited amounts of water from the ocean, create lakes, rivers and water falls, and indefinitely increase the hydroelectric power, of which there is now a limited supply. That led me to the production of very intense electrical effects. At the same time my wireless work, which I had already begun, was exactly in that direction, and I devoted myself to the perfection of that device, and in 1908, I filed an application describing an apparatus with which I thought the wonder could be achieved. The Patent Office Examiner was from Missouri, he would not believe that it could be done, and my patent was



never granted. But in Colorado I had constructed a transmitter by which I produced effects in some respects at least greater than those of lightning. I do not mean in potential. The highest potential I reached was something like 20,000,000 volts, which is insignificant as compared to that of lightning, but certain effects produced by my apparatus were greater than those of lightning. For instance, I obtained in my antennae currents of from 1,000 to 1100 amperes. That was in 1890 and you know that in the biggest wireless plants of today only 250 amperes are used. In Colorado I succeeded one day in precipitating a dense fog. There was a mist outside, but when I turned on the current the cloud in the laboratory became so dense that when the hand was held only a few inches from the face it could not be seen. I am positive in my conviction that we can erect a plant of proper design in an arid region, work it according to certain observations and rules, and by its means draw from the ocean unlimited amounts of water for irrigation and power purposes. If I do not live to carry it out, somebody else will, but I feel sure that I am right.

As to the transmission of power through space, that is a project which I have considered absolutely certain of success long since. Years ago I was in the position to transmit wireless power to any distance without limit other than that imposed by the physical dimensions of the globe. In my system it makes no difference what the distance is. The efficiency of the transmission can be as high as 96 or 97 per cent, and there are practically no losses except such as are inevitable in the running of the machinery. When there is no receiver there is no energy consumption anywhere. When the receiver is put on, it draws power. That is the exact opposite of the Hertz-wave system. In that case, if you have a plant of 1000 horsepower, it is radiating all the time whether the energy is received or not; but in my system no power is lost. When there are no receivers the plant consumes only a few horsepower necessary to maintain the electric vibration; it runs idle, as the Edison plant when the lamps and motors are shut off.

I have made advances along this line in later years which will contribute to the practical features of the system. Recently I have obtained a patent on a transmitter with which it is practicable to transfer unlimited amount of energy to any distance. I had a very interesting experience with Mr. Stone, whom I consider, if not the ablest, certainly one of the ablest living experts. I said to Mr. Stone: "Did you see my patent?" He replied: "Yes, I saw it, but I thought you were crazy." When I explained it to Mr. Stone he said, "Now, I see; why, that is great," and he understood how the energy is transmitted.

To conclude, gentlemen, we are coming to great results, but we must be prepared for a condition of paralysis for quite a while. We are facing a crisis such as the world has never seen before, and until the situation clears the best thing we can do is to devise some scheme for overcoming the submarines, and that is what I am doing now. (Applause)

ALFRED H. COWLES: Here are some pictures you gave to me twenty years ago, relating to your experiments of 1889, I think you will be interested in seeing them. (Hands pictures to Mr. Tesla)



NIKOLA TESLA: I have learned how to put up a plant that will develop a tension of 100,00,000 volts and handle it with perfect safety. This plant (indicating) was in Colorado. If anybody, who had not been dabbling in these experiments as long as myself, had done such work, he would surely have been killed. In this plant I had the narrowest escape ever. It was a square building, in which there was a coil 52 feet in diameter, about nine feet high. When it was adjusted to resonance, the streamers passed from top to bottom and it was a most beautiful sight. You see, that was about fifteen hundred, perhaps two thousand square feet of streamer surface. To save money I had calculated the dimensions as closely as possible, and the streamers came within six or seven inches from the sides of the building. As boys had been looking through a single window provided in the rear, I nailed it up. For handling the heavy currents, I had a special switch. It was hard to pull, and I had a spring arranged so that I could just touch the handle and it would snap in. I sent one of my assistants down town and was experimenting alone. I threw up the switch and went behind the coil to examine something. While I was there the switch snapped in, when suddenly the whole room was filled with streamers, and I had no way of getting out. I tried to break through the window but in vain as I had no tools, and there was nothing else to do than to throw myself on my stomach and pass under. The primary carried 500,000 volts, and I had to crawl through the narrow place here (pointing) with the streamers going. The nitrous acid was so strong I could hardly breathe. These streamers rapidly oxidize nitrogen because of their enormous surface, which makes up for what they lack in intensity. When I came to the narrow space they closed on my back. I got away and barely managed to open the switch when the building began to burn. I grabbed a fire extinguisher and succeeded in smothering the fire. Then I had enough, I was all in. But now I can operate a plant without any fear of its destruction by fire. Mr. Cowles is responsible for the excursion into this matter.

THE PRESIDENT: It there is no further business, we will consider this meeting as adjourned.

The meeting then adjourned.



NIKOLA TESLA: I have learned how to put up a plant that will develop a tension of 100,00,000 volts and handle it with perfect safety. This plant (indicating) was in Colorado. If anybody, who has not been dabbling in these experiments as long as myself, had done such work, he would surely have been killed. In this plant I had the narrowest escape ever. It was a square building, in which there was a coil 52 feet in diameter, about nine feet high. When it was adjusted to resonance, the streamers passed from top to bottom and it was a most beautiful sight. You see, that was about fifteen hundred, perhaps two thousand square feet of streamer surface. To save money I had calculated the dimensions as closely as possible, and the streamers came within six or seven inches from the sides of the building. As boys had been looking through a single window provided in the rear, I nailed it up. For handling the heavy currents, I had a special switch. It was hard to pull, and I had a spring arranged so that I could just touch the handle and it would snap in. I sent one of my assistants down town and was experimenting alone. I threw up the switch and went behind the coil to examine something. While I was there the switch snapped in, when suddenly the whole room was filled with streamers, and I had no way of getting out. I tried to break through the window but in vain as I had no tools, and there was nothing else to do than to throw myself on my stomach and pass under. The primary carried 50,000 volts, and I had to crawl through the narrow place here (pointing) with the streamers going. The nitrous acid was so strong I could hardly breathe. These streamers rapidly oxidize nitrogen because of their enormous surface, which makes up for what they lack in intensity. When I came to the narrow space they closed on my back. I got away and barely managed to open the switch when the building began to burn. I grabbed a fire extinguisher and succeeded in smothering the fire. Then I had enough, I was all in. But now I can operate a plant without any fear of its destruction by fire. Mr. Cowles is responsible for the excursion into this matter.

THE PRESIDENT: If there is no further business, we will consider this meeting as adjourned.

The meeting then adjourned.



Minutes of the Edison Medal Meeting only  
partially reprinted in Electrical Review  
and Western Electrician - May 26, 1917,  
and in print of this in Tribute to  
Nikola Tesla

W. H. P. Jr.

Frederick B. Hall,  
John C. Finney,  
A. B. Hallister

John A. Hall,  
Nikola Tesla,  
William H. Hallister,  
Wilfred H. Hall

George A. Hamilton

He declared the Edison Medal and  
the Edison Medal and the Edison Medal

He declared the Edison Medal and  
the Edison Medal and the Edison Medal

He declared the Edison Medal and  
the Edison Medal and the Edison Medal

He declared the Edison Medal and  
the Edison Medal and the Edison Medal

He declared the Edison Medal and  
the Edison Medal and the Edison Medal



*The* **EDISON  
ELECTRIC  
INSTITUTE  
BULLETIN**

*July  
1956*

**Utility Leadership in  
Industrial Development**

*Richard M. Alt*

**A Tribute to Nikola Tesla  
Report on the Aiken Project**

*Bernard S. Rodey, Jr.*

**Purchasing and Stores Meeting  
Traffic As a Purchasing Function**

*Frank E. Baxter*

**Aerial Triplex Cable Secondary**

*R. M. Grogan*

**Reports on Committee Meetings**

*R. W. White, L. B. Card,  
G. J. Yanda, J. M. Driscoll*



*Published Monthly by  
Edison Electric  
Institute*



# A Tribute to Nikola Tesla— Father of Polyphase Alternating Current

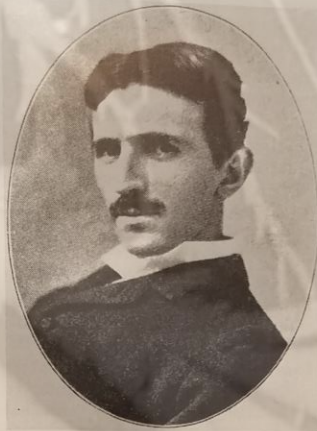
THE month of July marks the 100th anniversary of the birth of Nikola Tesla, a pioneer in the development and application of electricity. Despite the tremendously important contributions which he made to the electric industry, Nikola Tesla has remained comparatively unknown. It has been said that the principal reason for this is that his inventions, unlike the electric lamp and telephone, are not continually in evidence. As a result, they and their inventor are little known by the general public.

Tesla's two most important inventions were the polyphase alternating-current system for the transmission of electricity and the induction motor, with its basic concept of the rotating magnetic field, which was the heart of Tesla's new system. These have been described as being among the several most important inventions in the history of the power industry.

Born in Smiljan, Yugoslavia, on July 10, 1856, Nikola Tesla was the son of a Greek Orthodox Church minister who was also a linguist, writer, and mathematician, and an inventor mother. Nikola Tesla was well educated. Following his elementary education at Gospic and Carlstadt, he studied for four years at the Polytechnic School at Gratz, and later attended the University of Prague for two years. His interest in electricity was first aroused while studying in Prague.

## Technical Career Begins

Nikola Tesla's technical career began in 1881 when he joined the Government Telephone Engineering Department which was installing the American Telephone system in Budapest. It was while engaged in this work that Tesla invented a telephone repeater—his first electrical invention. He later went to Strassbourg for about two years where he installed, maintained, and repaired power station equipment, and then



NIKOLA TESLA

to Paris where he did electrical work for the Edison Electric Light Company. During this period, Tesla privately constructed his first commutatorless motor, but could not obtain capital with which to develop his invention. Attracted by the remarkable progress being made in the United States in the electrical field, and the greater opportunity which he believed existed here for one with his interests, Tesla came to this country in 1884.

## Works with Edison

Soon after his arrival in the United States, Tesla went to work with Thomas A. Edison designing motors and generators. At that time the Edison interests were devoted to direct current equipment, while Tesla was primarily interested in the development of alternating current. The association with Edison lasted only a short time, and in 1887 Tesla established his own laboratory on Houston Street in New York City. That same year he filed several important patents covering new methods for the production, transmission, and utilization of electric power.

The period between 1886 and 1903 is considered to have been Tesla's most productive in electrical invention. Altogether, Tesla is said to have invented over 700 devices many of which he patented. In addition to the induction motor and polyphase system, many of his other inventions were of considerable importance. He invented the Tesla coil or transformer, and laid the basis for subsequent development of neon lights. He also first advocated the use of oil in transformers. Tesla was responsible for other important developments of dynamos, condensers, and special coils. Little of his work after the turn of the century was directed toward the electrical power field, most of it being devoted to radio and other studies. In the field of radio his experiments, together with the inspiration which he provided others to achieve accomplishment, are also noteworthy. Tesla envisioned radio, television, and the airplane long before they became realities.

## Developing Niagara

The desire of engineers to convert the tremendous energy of Niagara Falls into electric power which could be transmitted to distant points for use was a major factor in the acceptance and eventual success of Tesla's great electrical inventions. In 1886, a charter was obtained by the Niagara River Hydraulic Tunnel, Power and Sewer Co. for a great power development at Niagara Falls. The initial plan for utilizing the water envisioned development of an industrial community close to the river for a distance of a mile and a half. Each of the mills would be driven by individual water wheels, and this involved the construction of a series of canals to supply the separate wheels, together with a discharge tunnel system. Careful study revealed that the cost of executing this plan would be much too great. The economic alternative was to locate all electric



production facilities at one point where power could be generated by the most efficient and economical means, and then transmitted to the mills wherever they might be located. A major obstacle to this latter plan was that it required facilities for transmitting the power over considerable distances, and at that time there was no adequate equipment by which this could be accomplished.

#### Devices and Systems

Electrical development in the 1880's was characterized by the invention of useful devices, such as a lamp or railway motor, and then the subsequent development of a "system" to operate the device. The system was usually identified by the name of the inventor. During this decade there appeared numerous such systems for different types of lighting and for a dozen street railways.

The same year that the charter for the development of Niagara Falls was obtained (1886), William Stanley, a Westinghouse electrical expert, successfully demonstrated a single-phase alternating-current system. He had developed it by completely revamping a system devised by Gaulard and Gibbs, the patents for which had been acquired by Westinghouse in 1885. The demonstration was followed by the design and manufacture of commercial alternating-current apparatus, and the actual inauguration of single phase a-c service in Buffalo in November, 1886. Current was transmitted at 1,000 volts and transformed to 1/20th of the voltage for 50-volt incandescent lamps. While the new system greatly expanded the area that could be served in comparison with direct current systems which were limited to a radius of one mile or less, the a-c system was handicapped by the lack of successful small alternating-current motors.

#### Announces Polyphase System

In May 1888, Tesla announced his new polyphase system of a-c motors in a paper before the AIEE. In this new polyphase system, two or three currents from the same generator followed one another in sequence. This produced a rotating magnetic field in the motor which in turn induced currents in the closed motor

secondary circuit, thereby producing mechanical rotation. Realizing the importance of Tesla's motor and what it would mean for a-c service, George Westinghouse acquired these patents for the Westinghouse company that same year. At the same time he secured Tesla's services in order to have him work on further development of the a-c motor. After working for Westinghouse for a brief period, Tesla returned to his own New York laboratory in 1889. Westinghouse engineers subsequently devoted much effort to adapting the Tesla motor to the predominant alternating current in commercial use at that time, which was single phase at a frequency of 133 cycles, but without success.

#### Niagara Contracts

In 1889, contracts were entered into between the Niagara River Hydraulic Tunnel, Power and Sewer Co. and The Cataract Construction Co. Under these agreements, the latter company became the representative of the Niagara company and assumed responsibility for the design, financing, and construction of the proposed Niagara plant. The Cataract Construction Co. organized the International Niagara Commission

and a world-wide search was begun by this Commission for methods and apparatus by which the enormous energy of Niagara Falls could be harnessed. The Commission, composed of eminent scientists from several countries, extended invitations to submit plans to 28 individuals or firms from six different countries. Seventeen projects were submitted to the Commission. Six were electrical and, of these, four proposed the use of direct current while two advocated alternating current. Of the latter two, one proposed single-phase alternating current but was not described in detail, and the other, submitted by Professor George Forbes, suggested a polyphase installation. His proposal said in part, "... the only practical solution for Buffalo and the best solution for the new industrial city which it is proposed to build near Niagara lies in the adoption of alternating current generators and motors. The only non-synchronizing motor which has been developed in a practical form is the Tesla motor. . . ." Although the Commission looked favorably on electrical methods, it was not convinced that alternating current was

(Continued on page 251)

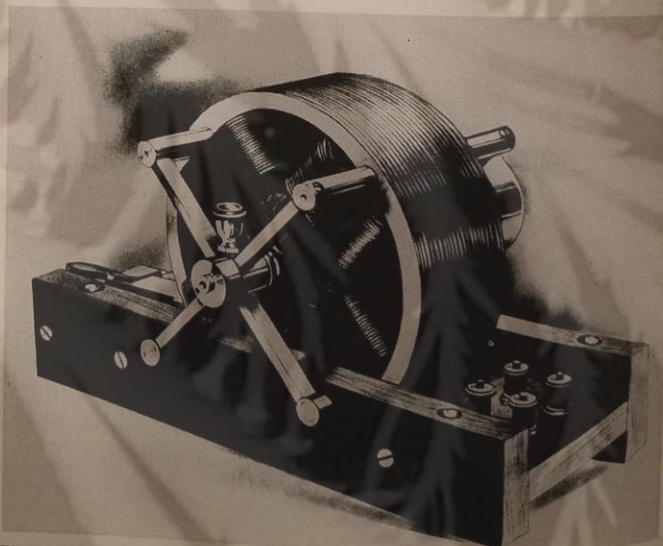


Fig. 1—One of the two model two-phase induction motors demonstrated by Nikola Tesla in his classic lecture before the AIEE in May, 1888. It was this motor, along with the polyphase system for the generation, transmission, and distribution of electricity that Tesla developed to run it, that became the foundation of the modern electric power industry.



Under these agreements, the company became the representative of the Niagara company and assumed responsibility for the design, financing, and construction of the proposed Niagara plant. The Cataract Construction Co. organized the International Niagara Commission

synchronizing motor which has been developed in a practical form is the Tesla motor. . . ." Although the Commission looked favorably on electrical methods, it was not convinced that alternating current was  
(Continued on page 251)

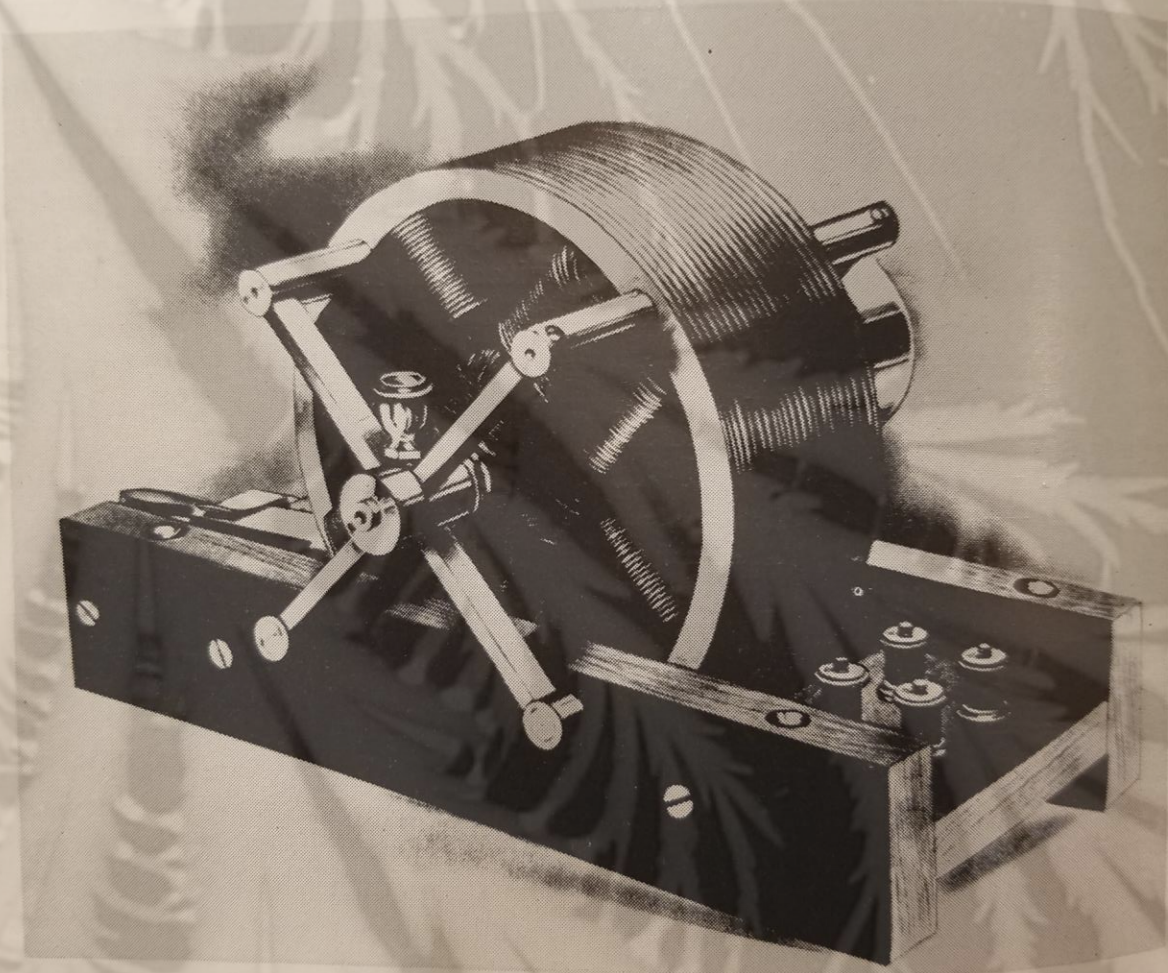


Fig. 1—One of the two model two-phase induction motors demonstrated by Nikola Tesla in his classic lecture before the AIEE in May, 1888. It was this motor, along with the polyphase system for the generation, transmission, and distribution of electricity that Tesla developed to run it, that became the foundation of the modern electric power industry.



**TESLA'S CORRESPONDENCE WITH RELATIVES**  
**TRANSLATOR, NICHOLAS KOSANOVICH**

**PREFACE BY DR. A.S. MARINCIC, DIRECTOR TESLA MUSEUM  
BELGRADE**

There are about 70,000 letters of correspondence and about 7,000 correspondents. This book contains the original letters to his relatives and those letters received by him-including telegrams. These letters were written during a 60 year period from 1882 to 1942. It is logical that there are about seven times more letters written to him than by him to others. A large number of correspondence to Tesla were from other sources and even up to the present a small number of his descendants gave few copies to the Nikola Tesla Museum. Tesla himself did not replicate his correspondence to others.

Most likely the reader will see no replies to letters about interesting questions or discussions from the letters that can be anticipated by any collection of this type of correspondence. In fact, we should be most grateful that Dr. Tesla preserved all of these letters which were precious memories to him and they were spiritual ties with his sisters and close relatives with whom he corresponded. Undoubtedly, this correspondence had significant historical value to the personal life of Tesla and for a better understanding of his views about human problems and of his close relatives and friends.

A very huge effort was demanded to prepare this collection of Tesla correspondence from the phase of collating, deciphering handwritten letters to preparing documents that enabled us to identify the people in Tesla's family tree of both his father and mother up to the phase of comments and compilation the register of names, geographic locations and correspondence. The workers at the Nikola Tesla Museum deserve a special appreciation of gratitude for its diligent work. A special thanks to Dubravka Smiljanic and Zorica Civric who is also the Curator of the Museum. We would like to remind the reader that this is the first of its kind of anthology in Yugoslavia and the world. The staff prepared it with professional presence and enthusiasm.

This anthology of correspondence was published in the year that was proclaimed-"Year of Nikola Tesla in Yugoslavia" and marks the 50th anniversary of his death-one of the great engineers of all time-1993. It is also a significant anniversary-100th Anniversary of the Chicago Exposition where Tesla's polyphase system began its triumphant application to the world. Only 100 years ago electrification of Serbia was introduced in Belgrade 1892. The world was the beneficiary from many of Tesla's inventions; many are still utilized today, and most likely in the future.

Tesla's correspondence in this collection is only a portion of his rich legacy which is in the Nikola Tesla museum for posterity. This museum will publish more books in the future. To everyone who assisted in this endeavor-in the first place the Electrical Industry of Serbia and the tireless inspiration and organization by Radmila Ivankovic and those engineers, Also the donors who helped fund the cost of this book. We hope that she will be a participant in the next publishing effort by the Nikola Tesla Museum, We owe much to one of the greatest Serb cosmopolites who was an inspiration to many in the past and those in the future.

BELGRADE, JUNE 1993

PROFESSOR DR. ALEKSANDAR S. MARINCIC  
BELGRADE UNIVERSITY  
DIRECTOR, TESLA MUSEUM

NICHOLAS KOSANOVICH

TRANSLATOR



MARICA to Nikola Tesla  
Tesla's sister

Plaski, 1882

Lika

My Dear Brother!

I am writing this letter to you with tearful eyes and why tearful eyes? This question I know that you will not understand-moreso about I can tearfully write. I have no reason for tears, this, it would have been enough-and that is- after 6 years a letter to a brother(God knows to whom I write) will answer. My dear brother, above everything else, I ask that you reply, and honestly I don't know how to tell you, that hearing from you would make me very happy.

Mother came here for a few days to Plaski by us, and she begs that you write to me. She is well. They have a new parish home now. It is that home next to the gimnazium(high school)

I am well; I have two children and lost two children.

Little Danica(older) is 5 years old. Milica who came after Danica, passed away. Dragis, whom we named after Draginja, was a still birth. Now I have a son 3 months old. I gave him father's name, Miluutin.

I am happy and satisfied with my life thanks to God, but, I grieve for my family. I am far away from all of them and never see them. I did not see mother in 2 years until day before yesterday. She arrived here. It is the same for sister Milka. And you, whom I love most, cannot see you; at least get a letter from you from time to time.

I have five male in-laws. One is a Lieutenant who is Jovo. The second Svetozar hopes that soon will join. The third Sava received a Tekelija scholarship to study medicine-but due to the Hungarian language which he must learn at the University of Budapest, cannot remain there. Now, he came home.



He is taking a year off and he is physically weak. I hope he studies Theology next year. The fourth, Djuro, is studying religion in Karlovac and is in the 5th grade of high school. The youngest Stevo has a small school stipend and is in fourth grade of the Realka (high school).

Sava was in Budapest and got your address—thank God he was able to get it. Now, I can write to you.

Angelina & Jovo are well. They have 3 children—Soka, Perica and Mirko. Two months ago Milka gave birth to a daughter and named her Djuka after mother.

Dear brother: In the name of mother now standing beside me, I beg you to write at least one letter—just like the one to Vujo that you long for the family. Please, write to me and I will keep you abreast of everything here. and everybody most accurately. How sweet it would be to get a letter from you! What would please me more would be a photo of you.

My dear brother, make us happy, to a caring mother, send a photo of you. Here she begs you to do this.

I would have hope dear Nikola that you will do this. How many times of a wish of a sister and a mother? you don't know how many times mother mentions you—how many times she cries! She has you as an only son—if you write then I will have things to say.

I feel that if I were in your shoes, I would be happy to receive letters, more than God knows what, it would be a cure for longing.

Nikoladin and Sava send you greetings. Niko has written you some letters and could not find your address.

Mother requests a reply and phot. and about your father's tobacco, we can send it.



page 4 cont'd

How sweet it would be to receive a letter from you!

What would please me more if you sent me a photo of you.

My dear brother, make us happy and a caring mother happy,  
send a photo. She begs you to do this.

I have hope dear Nikola that you will do this.

How many times this wish of a sester and a mother would be  
fulfilled.. You don't know this, you mother mentions you very  
often - how many times she cries. She has only you as a son.  
If you would do this for her

I have hope dear Nikola that you will do this. How many  
times this wish of a sister or a mother was asked. You don't  
know how many times your mother mentions you-how many times  
she cries. And you know that she has you as an only son  
and then I would have something to write also.

I think that if I were in your shoes, I would be happy to  
received letters, more than God knows what, it would be a cure  
for longing.

Nikoladin and Sava send you greetings. Niko would write  
you some letters, but, he could not find your address.

Mother asks for a reply and a photo, and if you wish father's  
tobacco, we can send it.

[page 5]

All the uncles and aunts are well. Now, I beg you to reply  
and accept our warmest greetings & spiritual love

From sister, Marica Kosanovic in Plaski, Lika and  
now tears flow from my eyes, because, I am afraid of what is  
my names and where I am. WITH GOD

repeat  
from  
previous  
page



72  
page 6

Nikola Tesla to Sima<sup>o</sup> Majstorovic

N. Tesla , E.E.  
Astor House  
New York, USA

New York  
Jan. 9, . 1890

Dear Simo!

Here I am today sending mother 150 forints(\$600) and sent 150 forints as soon as I arrived here. I still did not hear of word from uncles or sisters whom I had written. I am anxious to know how you are. I am especially concerned about Marica; let me know as soon as you receive a letter. About the wine, no trace or word, maybe friend Gomijac rethought after finding the price . My job suits me fine; I will shortly tell you the news. If you have gone to the Adriatic(Primorje) or intend to go, tell my mother & uncle about those 100 Forints that I had promised; I will send this money as soon as you arrive and need it. Just take care of yourself that you become well. Say hello to my mother and uncles and in-Laws and the rest of the family.

Your Nikola



Jovo Trbojevic to N. Tesla  
Petrovo Selo, Lika  
Jan. 14, 1890

Dear Nikola:

*not in book*  
I received your very warm letter of December 11 in order only a little late to Petrovo Selo in Srem(Vojvodina) and it went to Slavonia-write "via Carlstat"(Karlovac) and it will come on time.

At your friendly urging it looks like a huge sum of money; thank you ever so much; you know that this made us very happy. because, with this, you showed concern about us. Again, Thank you!!!

I do not need money for this year, because, I do not see any problems ahead and our harvest will be rich.

If you find yourself in a good situation, and I am sure, a greater benefit will be to you and me in this situation to ask you for a sum. Only it is understood by itself that your capital with my honor and respect, and with all your assets in every aspect loan me and send it to me. I would be dead rather than waste your money and ruin my reputation. On December 14 I sent you a book-poetry of Joyan Jovanovic Zmaj which I presume you received by now. ||

All of us here, also your mother, Milka, uncle and those in Gospic and Marica, Nikola and children in Plaski. We wish you the best. Thank God that Marica's health is much better and out of danger. We received a letter from Nikola and he mentions that Martica takes daily walks are longer and longer and when the weather is fine she would come here. For now nothing more than the warmest greetinga and a soulful kiss.

I remain Yours Truly,

Jovo Trbojevic

[page 8]

P.S. All Serbian and also Croatian and some German newspapers wrote nice articles about you-Niko Kosanovic will send you some books one day. If your work allows, and if you can, be kind and write more often.



#4  
Page 9

Marica Kosanovic to N. Tesla  
Tesla's sister

Plaski, Lika  
Jan. 22, 1890

My only Brother!

I must write a few words, that is why I took a small sheet of paper; If I took a large sheet, I would not know when to stop writing.

My health is back again and I don't think I will go to Rijeka and besides this year was a mild winter. (Rijeka is semi-tropical).

I received now a gift from mother in Gospic. I did not hope to receive a letter from Simo<sup>(Magistoroni)</sup> he writes that his health is improved, and we believe him; we see on St. Sava's day a 'welcome to a lecture' will be a speech by him.

I know that this will please you, because, all of us lost hope in him. Mother, uncle and Milka are well.

Here is some literature; we shall see that you get the latest literature and news.

Dear brother, see that you do not over exert yourself. Your frail body construction and large effort gives us great concern. I know already what you will say about this.

I don't have to tell you how nice it would be, if you would write a word or two. I know that this is not for you which would relax you and make us happy. We wish nothing more than your good health and happiness in your work. Our dear Sokol: Don't take offense for what sister says and most sincere greetings from all and acquaintances.

I kiss your Soul      From Your Sister Marica



#5

PAGE 10

Nikoladin Kosanovic to N. Tesla

Plaski, Lika  
Jan. 24, 1890

Dear Nikola!

1. missing tooth

We received your letter. Thank you that you replied. I am sorry that I did not answer about that idea in the letter <sup>as</sup>

it does not matter.. While your head is around, there will be many more new ideas.

Marica is fairly well. She is not ~~going~~ going to the seashore. It happened to be a rather mild winter.

We received a letter from Gospic and they say that everyone is well. The same news from Petrovo Selo. That is one who from Petrovo Selo who is called 'Masin' -what they don't say about him, when he sits down, that he....

However don't let the 'skrb' not eat you up or debilitate your health which is a deep concern for mother and sisters.

I am sending two packages-eight books to read while you are relaxing. They are very familiar to you-Gorski Vjenac & Smrt Smaila Aga Cengic-including some prose & poetry which our critics say are best for the last few years. Some plays of Veselinovic (Serb Village Teacher) and Lazarevic who was translated in major languages including French & Italian, etc.

I also included one copy of 'Branika' & 'Serbian Voice'. Then, you can see how serdom is represented. These are more or less representative works that I have heard and read about.

Do not get angry at the headline "Serb Inventor" in America but the paper Branko makes their own headlines.

The editor thanked me for my nice letter and asked me privately to write articles about you.

PAGE 11

But what can I do, if I don't get some Newspapers from there- I would have found, who can interpret some things.

However, in the name of Srbdom and Slavdom, I beg you ~~do~~ that you forget about us due to your mental efforts on your work. Otherwise your mind. Your mind will illuminate only there in a foreign land- but for your relatives & people will completely go out like a spark into ashes. I read somewhere recently, that they are opposed to electricity and lighting. N I don't know if that is relevant.

We would be very happy, that you answer this letter-even a short note, I know that you don't have nor time to write a long letter.

I wish you the best of luck, but above all, best of health.

Your Loving Nikoladin, Very Rev.

① MOUNTAIN WREATH - NJEGOS - ode to LIBERTY



Simo Majstorovic to N. Tesla

Gospic, Lika  
Feb. 6, 1890

Dear Nikola!

I would have replied to your first letter, but, there was an illness and evil attitudes, and again, an unborn tendency not to write.

As far as health here is concerned, it isn't the worst; <sup>o</sup> your Aunt is fine and is back to herself really, since you planned to come here. Thank you for your bravery prior to your departure but recognize that there were tears on one of the other sides. Uncle's sickness debilitated him-however, he is well now. The same is for the students.. Only the three of us, I, Milka & little Gina. "bojtamo za sav lovinac" Milka was at the doctor's in Gracac and came back soon on the 5th or 6th day. She says that she cannot be with uncle, ~~because~~ because, there is no room and papo had not yet moved; he has to remain in Zrenjanin as an Administrator; I have to wait until she offers and God knows when. Gina suffers from impertinence and I from old age.

Every one is well in Petrovo Selo. Jovo visited the other day and saw the young one. He never looked so well as he does now. He says Angelina is well also.

Nikola wrote from Plaski yesterday, that he and the children had influenza-now Marica has it; otherwise, he says that she is much better since you left. Aunt took some of the money that you sent and gave her 20 forints and sent it immediately.

We received the money on time, and also the letter. Aunt says the you take care of yourself and be concerned more about yourself. She says that the money is sufficient for her.

PAGE 13

She wishes nothing else and feels and the future security of yourslef. You can make fun of me, but, this was at her bequest.

Uncle (Trivun-Trifun) Mandic was here for Christmas. He wonders what it is with the wine---s--- there is none there. He fears traveling by sea may lose his strength and he begs you to explain this to him as soon as you receive this letter, because, he is very concerned about this..

Life is the same in Gospic Lala was sick again-but this time of influenza; his ears ached. Poor Lala could not even on E Epiphany & St. Sava's day get out of bed-that is how it was for him this year.

He unceasingly leads his Army toward Kosovo but never arrives. As soon as he arrived to Malena Banska just before Kosovo not being able to drink any more then another General.. takes over and there is a search for a nother Field Marshall.. Mita even today strives, to prove, that capability is older than matter

Ondra - 'fighting for the Prize'



page 13 cont'd.

Simic is drowning himself in philosophical studies, but, he doesn't know how he will swim out of them. Pensioners like pensioners and like myself shake the world and endure many hardships and let the mice learn for me.

The St. Sava ball went fine. Buda (Budisavljevic) was there with his wife and children and paraded with uncle who was dressed in his son's silk. You know that it was worn once before; and when will she wear it again; that I don't know. Buda was very happy and because of this, he didn't show himself on the street. since St. Sava's day (most revered Serb St.) He is very weak from influenza. Otherwise, the others are fine. The Serbian Parliament meets April 24, new calendar (Gregorian) and the elections are on March 10.

Baron Fedor Nikolic was named the Emperor's Commisar who is a friend of uncle's. He will be in the Hungarian Parliament.

There is violent agitation in the newspapers for Stojakov & Brankovic. The people are divided into two groups; if you find Brankovic's or uncle's stock in the stock market, buy them, because you will gain that is how are matters among the people and the gov't. He will be a candidate with uncle and campaign in their county with Brankovic and the people. He is undertaking a role as interlocutor between Brankovic & uncle in known matters.. He is handy for this and couldn't be more qualified. Uncle will travel to his election township to campaign for himself. rather than work for the staff of Brankovic, whom he promised to help in Gracac; he wants to secure himself. As you see, a very smart thought. He will go to Zagreb about the 20th of Feb. He will write from there and now he is so busy that he doesn't know where his head is.

PAGE 14

Accept greeting from all the friends and relatives-be well, satisfied and happy with your lot.

Brother SIMI

N.B. 100 forints, Thanks cannot take and will not.

#7  
PAGE 15

Jovo Trbojevic to N. Tesla  
Tesla's Brother-in-Law

Petrovo Selo  
Feb. 27, 1890

Dear Nikola!

Your letter the 9th of this month was received yesterday. There were 4 checks from 'Bazela'-one for 100 Swiss Francs 5 sous-one for 126 Swiss Francs 80 sous. That came to 1,027 Fr plus 8 sous. In Austrian money that is about 47 forints 5 schilling. 15



PAGE 15 CONT'D.

They figured every dollar worth 5.01 Francs which amount to 483 Forints.

I do not know what type of Post Office is in Basil and the one in Vienna that here it is near 17[...] fewer than what you sent?! However it could be for postage fees in Basil were determined, because of the exchange rate put too much is short. So that you know the truth, I am sending coupons from the money orders, then, you will see that the Post Office made a mistake and this should be made known.

I am sending my receipts to you, not knowing what good it will do, ; I cannot tell you what the interest will be, but be sure I shall tell you exactly in due time.

①  
AWEIZUNGAR  
SWISS MARK

I in my last letter to you at your respectful request thank you and said, I do not have the opportunity to invest your money at a favorable return. I want to make sure that the investment is secure and profitable.

Our Marica may give birth any day now. That is if God wills it and she overcomes this crisis and her health will most likely improve. Her illness is mostly of her pregnant condition. I will make use of the money and give it to her as she needs it.

PAGE 16

On March 3rd I thought of going to Zagreb with little Nikola to see the doctors for the spots on his eyes for a visual examination. If they cannot help then I shall go to Budapest and Vienna. I am afraid that if he gets older they may become worse..

We here and as well in Gospic and Plaski are well and in fairly good health-only some influenza attacked some of us. Marica is turning for the better now and as they write us, she may give birth any day now.

Write more often, especially if you are successful with a new invention, because you don't imagine how much any new invention or new idea concerns us.

Accept our warmest greetings from all of us .

I remain Jovo Trbojevic

# 8

PAGE 17

Rev. Nikoladin Kosanovic to N. Tesla  
Tesla's Brother-in-Law

Plaski, Lika  
March 27, 1890

Dear Nikola!

We received your 2 letters a few days ago, and we did not reply immediately, because, we were waiting to resolve the Gordian knot with Marica and be able to tell you. All is solved happily on March 27 around midnight. Marica gave birth to a daughter and your 100 forint money order help very much. Thank you! When we baptize the baby, we will have a drink to uncle Nikola's health who incidentally was the first to congratulate the first arrival-Marica firmly believes that her health will improve a lot. She thinks her sufferings were the consequences of her pregnancy, She will not go to a thermal spa if God wills it.

Now?

① EXCHANGE OFFICE



PAGE 17 CONT'D

I received the magazine 'Electrical World'; you can imagine how happy we were-Serbs & Slavs who knew you up to now, but if God wishes, they will know you more. You will probably read, there was a gathering in Zagreb with uncle Peter (attending to hear some famous Russian singers) and said to me and they will subscribe to some Serbian papers for mother in Gospic and she is well.

Marica will write to you personally as soon as she is up & around and I shall write more in detail because this is a hurry up letter as a result of getting your telegram & I could not send you one immediately. There is no office here and the mailman does not know the other one and how much it would cost to reply and send it to you.

Recently a German paper shows you, [...] "as" (...) Edison & very beautifully, but, he doesn't say his source for facts. often mentioning from

PAGE 18

about your life-biosketches. It praises along with you uncle Peter Mandic-it said that you are a nephew of Very Rev. Petar (Peter) Mandic.. And it comes to mind that, you say, putting salt on a bird's tail." & then, then

For now there is nothing new and accept greeting from Marica, myself, Sava and Maja.

Your Nikoladin

Plaskin Mar. 27/1890

# 9

PAGE 19

Marica Kosanovic to N. Tesla  
Tesla's sister

Plaski, Lika  
Easter 1890

My Only Brother!

Before anything else, I must write to you in the first place.

First of all, thank you very much for the wonderful gift, because, it not only pleased me that it is from you, preferably it should have gone to Angelina and I with all kinds of problems became superstitious and took this gift as a (bonumemem) that my only child will be fortunate. Today in the afternoon we received a telegram and it strengthened me from my weakness- to tell you the truth I cannot thank you enough for your brotherly concern.

Even today I am very weak, But I hope that I will get better little by little.

Mother is happy and well; I heard from Niko Majstorovic who was here with Geno Ilic.

Uncle was elected unanimously as a member of the (Sabor) Parliament which will convene on April 22nd-also Niko is going to the Sabor-Niko was elected from his region.-now is the election of a Metropolitan (Archbishop).

I congratulate you on your progress and don't have to show my happiness & enjoyment to you-not only among us, but also everyone here feels the same. To you it isn't my prattling is too much! I close with most respectful greetings & best from all of us., especially from a kiss from Sister Marica

All are well in Petrovo Selo. Jovo was here recently.



# 10  
PAGE 20

Marica Kosanovic to N. Tesla  
Tesla's sister

Plaski, Lika  
June 7, 1890

Dear Brother!

I received your letter that I have been waiting for lika a "frozen sun", because all of us feared that you were angry at us; that your telegram was answered with a letter by us

Thank you for your brotherly concern and preoccupation. I am fairly weak and I cannot remove the fever or shake it off. That is why I take a daily warm bath to regain my strength - were it not for your insistence, I would have fallen apart.

I have to find a (dojkinju) nanny for my baby. I would not leave the baby alone

Mother (Djuka) has recently written and everyone is well there. For any thermal bath (spas) they did not mention it. Any type of spa would be useful for her. I believe uncle doesn't need to go to a Spa. Angelina was here the other day. She lost some weight due to her illness, but, She is completely well now. Our parliament being so far is a small matter to us, especially to a cosmopolit like you. Nikoladin (Rev.) went to Gomirje, otherwise he would have written to you

Your letter made me so happy and encouraging and I thank you for that. Everyone is well here and wish you the same. Accept my Love

Sister, Marica



#11  
PAGE 21

Marica Kosanovic to N. Tesla  
Tesla's sister

Sutinska  
July 19, 1890

My Dear Brother!

I am already three months here and I feel much better now. The fever has left me almost completely and I regained my strength. This Spa(Banja) is a few hours from Zagreb and one doctor says that it is one of the best in the MONarchy.

I didn't hear from you in a long time; you must surely be occupied with something new.

Uncle Pajo(Paul) will visit me here because Varazdin is only a few hours away from here. I hope he comes any day now. He will visit Petar who is at the Varazdin Spa also.

Jovo Trbojevic gave me sufficient money and I thank you a hundred times. Last summer mother wanted to visit me but I was here at the Spa.

Angelina was a little under the weather and I hear she is well now. When I feel better here I will visit a doctor to see if last year's illness affected me.

You told us last year that you are coming to visit this year, but I am afraid that you will not come.

Please, in the names of all of us, write at least to one of us; we shall reply immediately.

Wish you health & luck in everything.

Your Loving sister,.  
MARICA



#12

PAGE 22

N. Tesla to Petar Mandic  
Tesla's uncle

New York, NY  
Aug. 18, 1890

Dear Uncle:

I received your letter late due to the fact that I was not in New York. All the news, excerpt yours and in Smiljan healthwise made me happy. I am surprised that you are undecided about staying at home. I think that you will not find anywhere the love and respect that you have at home and what kind of life is it among strangers? Here I am completely alienated and sometimes it is difficult.

I have to tell you some sad news. My best friend and the only one who had supported me during my first attempts and whom I loved dearly because of his virtues and respect, passed away. If this man had lived, there is no doubt with his unusual talent and ability and my ideas; there could be fame for some years.

There is no word or trace of the wine; most likely I will not get it for two or three months- if you shipped it through the Mediterranean Sea- it is one hundred times worse in Paris and you know how it is there! I think that it is best to send Hungarian wine because Dalmatian is too heavy for me. Don't worry about the cost. I will pay for it immediately, but, I don't know where and how. I sent mother 140 Forints & she hasn't written in 2 or 3 months for me to know if she gets the money regularly.

Hoing that this letter finds you in good health and greetings to dearest mother and sister.

LOVE, NIKOLA



# 13

PAGE 23

Angelina Trbojevic to Tesla

Petrovo Selo

Tesla's sister - Wm. H. Terbo's grandmother

Aug. 18, 1890

My Dearest Brother!

I wanted to write to you a long time ago, but, I thought my letters among your very busy activities & schedule would disturb you and if I thought that it wasn't so, I would write at least once a month.

Since you sent the Easter telegram to Marica that you may be coming, we always looked forward to that thankfully and the summer is half gone and still you did not arrive, nor do you write to us to let us know if you are to embark on this difficult journey-after 3 years to visit us.

Do you know my Nikola, we and our close relatives and the whole world anxiously anticipate your arrival; this might unnerve you with our overwhelming happiness. You sent me only money only twice-the first time 140 Forints and the second 118 Forints for which I thank you very much. God knows how thankful I am that you remembered me. and the money came in handy which was used for the children whose school year was ending-it was distributed to them. Pero(Petar) is studying law in Budapest and Uros is completing the third year of the gimnazijum(high school) in Rijeka. Now, I must send Niko to the gimnazijum. He completed four grades on the Honor Roll. He is the most gifted of all our Children.

PAGE 24

Here Jovan's old father is with us; he mentions you often and wonders if he will see you again. He is prepared for death. We are all well here and I hear Milka & Marica are well. Please write. We follow you in the newspapers. There is often news about you in our newspapers and we are reborn when we read about you.

There is a Dane Doic from Pribor in the U.S; tell me if you know him.

Greetings from papa Jovo and our children and Love from  
Your Sister Angelina.



# 14  
PAGE 25

Marica Kosanovic to Tesla  
sister

Plaski, Lika  
October 26, 1890

Dear Brother!

I received your letter and 100 Forints, and moreso it was beautiful; thank you for it. It comes in handy. I wanted to send it to Jovo, But, the next day we received your letter. That's timing-I want to thank you for helping me come back to health and the baths(Spa) were most helpful. I regained my strength and no more fever.

Our Stevo(in-Law) was in Gospic for 15 days with mother to prepare for his wedding; nothing is completed there, even though he intended to.

He wooed Joco Bogdanovic's daughter but Joco refused. I think that he repents now not offering his daughter to this lad, since he has 7 daughters besides her.

Mother is well and happy. Stevo says she is holding up well and I think due to your generosity..

Uncle is in Zagreb; Milka & Gina are well-Simo Majstorovic has completely recovered but always coughs. His brother Niko went into the Seminary to study Theology.

They are all well in Petrovo Selo and Angelina will go to Rome soon-I think that I will go if it will be of any help. Niko and all the others are well and thank you for the gift.

I just run at the mouth so that you have to read my verbosity. I conclude and offer Greetings from all

Kiss you in Spirit, Your thankful,  
Marica

#15  
PAGE 26

Jovo Trbojevic to Tesla :  
Tesla's Brother-in-Law

Petrovo Selo,Vojvodina  
Nov. 24, 1890

Dear Nikola!

Only now I have time to write and tell you that on Nov. 11 Angelina gave birth to a happy and healthy daughter. At the first mention of this, Marica immediately came from Plaski and attended to Angelina & her children and also managed the house for everything.

Angelina is already up and back to herself. Now, she is out of any danger; naturally with the help of care and cuation and a healthy diet.

I myself don't know how I was frightened of thses catastrophies, now, thank God everything is fine and all are well.

Marica will probably come home and mother nor Milka didn't come here yet, and we don't know if they will. I might have to find someone to stay with Angelina for a while.

Maric & her children, for now, thanks to God, are well now. However Marica should take care of herself and work less, becuase, I am afraid even though she is well now, but, weak. Those in Gospic are well; uncle is in Zagreb this month at the parliament(Sabor)

On the 20th of this month Bishop Zivkovic passed away in Plaski and was buried on the 23th in the Plaski cemetery.

As an intellingent and gifted human being, who among us, and there ar few will mourn him, even though on occasion he was criticized, he did a lot of good., Who will replace him, one does not know



PAGE 26

Jovo Trbojevic to N. Tesla  
Brother-in-Law

Petrovo Selo, Vojvodina  
Nov. 24, 1890

My Dear Nikola!

Only now I have time to write and tell you that on Nov. 11 Angelina gave birth to a happy & healthy daughter. At the first mention of this, Marica came from Plaski her and attended to Angelina & her children and also managed the house.

Angelina is already up and around and back to herself. Now, she is out of danger, naturally with care and caution with a healthy diet is helpful.

I myself do not know how I was frightened of these catastrophes, now thank God everything is fine and all is well.

Marica will probably come home and mother nor Milka have come here as yet. We don't know if the will come. I might have to find someone to stay with Angelina for a while.

Marica and her children, for now thanks to God, are well now. I am fearful even though she is well; she is weak.. Those in Gospic are well. uncle is in Zagreb this month that the Sabor (parliament).

On the 20th of this month Bishop Zivkovic passed away in Plaski and was buried on the 23rd in the Plaski cemetery.

As a Gifted and intelligent human being, who among us are few,, we should all mourn him. He did a lot of good.

Who will replace him, one does not know.

PAGE 27

About the wine in Dalmatia, I sent a capable and reliable manto bring it when he comes. If it is good, I will send a few bottles for your to taste it and you can determine the quality and order a large quantity.

Be good and write to us and tell me all and you yourself knows that we are concerned about you. Accept sincerest greetings from Marica, Angelina and our children. Most of all your

Jovo

P.S. Jovo Takulja's son is an apprentice in Gospic with Dimitri Jovic.

He is a lad of 18 years strong and healthy. He completed the 5th grade; he is very gifted. He is a plasterer. He wants to come & remain there always. Be good and tell us if he can get work there and help us also. His father has many children & little money. If you can loan him for his fare . Please answer whether you can help!

repeat  
B  
gmina  
page



#16

PAGE 28

Nikoladin Kosanovic to N. Tesla  
Tesla's Brother-in-Law

Plaski, Lika 0  
Dec. 1<sup>st</sup>, 1890

Dear Nikola:

Before anything else all of your folk in Plaski, Petrovo Selo and Gaspic are in fairly good health. Mother coughs like an old person but she can go another 20 years if God wills it..

Angelira recently gave birth to a child; Marica spent 15 days with her working around the house until Angleina felt well.. She came from Petrovo Selo yesterday. She again, Marica, is much better than last year. It would have been difficult without your material support thanks to your brotherly assistance. Especially last summer when she went to the baths(spa) to cure herself. Thank you ever so much!

The biggest news is here that our Bishop died and this on Nov. 20. He died from (Blutzstuvz) in great pain. Many newspapers say seriously that Petar Mandic will be his successor. This would please us and the people, but, there are those who are shakers and movers and we shall see.

My youngest brother Stevo(Kosanovic) married the other day. He took the neice of Nikola Dosen and the daughter of Rev. Mane from Pocitelj.

He will have St. Nicholas, like you, as his name day. May God give them health and a long life working and thinking for the benefit of humanity and the Serbian and Slavic peoples, who today are proud, that you are their son.

Marica will write to you a special letter tomorrow. Today, she cannot. We killed a pig and she is preparing it to make sauges, etc.

With the warmest greetings from all of us.

Your Nikoladin

Plaski, Dec. 1, 1890

Blutzstuvz-German word

note: Nikola Tesla writes (God) with a lower case. but, the women aand Rev. Kosanovic use a capital latter"G".



# 17  
PAGE 29

Marica Kosanovic to N. Tesla  
sister

Niko is Marica's husband

Plaski, Lika  
Dec. 14, 1890

My Dear Broter!

Niko wrote to you the other day and wished you a happy name day and I am waiting for the photographs.  
"Propusti Vrijeme (abandon time), but without this up to a point I believe in my desires.

I am sending father's and my photos and I hope that you like them. Everybody is well in Gospic, Petrovo Selo and Plaski.

I was in Petrovo Selo because I helped Angelina. She gave birth to a daughter and named her Marica.. Sava was the Godfather. Angelica and the baby are well. When I came home, I found a lot of news.

Our Bishop passed away. I know you are aware of it through the Serbian paper.

It is possible that uncle will replace him and that God would ordain it.

Our Stevo recently married. His wife is the daughter of Rev. Mane Dosen. He was after Rev. Josa's daughter from Divoselo. but I don't know why he got the boot (basket).

The letter that you recently sent to Petrovo Selo I read.. It hit all of us in a quandry. I write that things are not going quite well and dear brother do not (naprezati) unnerve us! We are very concerned about you and I know what you want.

Accept the warmest greetings from all and in spirit.

LOVE your Sister Marica

# 18  
PAGE 30

Marica Kosanovic to N. Tesla  
sister

Plaski, Lika  
May 24, 1891

My Dear Brother!

It is a long time between letters that concerns us. We are not worried about your health, but, that you are overworked.

Uncle left Gospic for good; this is what you know and he is not at the Sabor (Parliament) in Zagreb. He is waiting for the Patriarch's decision and become a monk to be appointed a Bishop.

Mother is well. We thought that uncle's leaving would upset her, but, it did not. Thank God that she is brave.

We do not know what will be in Gospic if Niko or someone else will get the assignment!

I think that even you would like us to come, but, of mother but I am afraid that she would benefit going with me and 4 small children. Uncle says that she would like Niko to come then mother. We are hoping and happy that you will come as you promised, but I am afraid there is a big (strapac?) and you will be weakened like last year.

However it can "krijepiti" as you know with how much pleasure we anticipate.. Siro is in Zagreb. He feels much better and looks much better

I hope that uncle will come tonight and will tell you how it is with him.

Everyone in Petrovo Selo & Gospic are well and also with us, Niko will write to you, but, he thinks he will wait until he has something to say. I think that you wait more than 100 times for a letter from there

Wish you the best of health Love, Your sister Marica



#19

page 31 Tesla's Correspondence with Relatives

Angelina Trbojevic to N. Tesla

(Not site) ?

My Dear Brother!

I thought that you would write and tell me about yourself, but, I cannot wait for that. So, I am writing a few words. We are all relatively well here and so is Milka and her family and she is in Plaski now. Jovo is at the Sabor (Parliament) since May 14 and told us that Marissa is relatively well. Thank God. Jovo's father is with us since he retired and now, Uncle Mojo is the Administrator. Niko (Nikodim Kosanovic) will get the Rijeka parish as Administrator and if God will it he will be fortunate if chosen. Nikola, look around among the Gospic people that they choose Jovo as Pastor/2/ that would be the only salvation for our children; it is funny five children and already three students and each having the highest grades in his class. If you plan to come to visit us this summer, look dear brother that you help your sister. We do not have anyone except you. Uncle Petar (Peter), you know how it is with him/0/3. I am to him the 50th-Mandic, Ilic, Majstorovic and all others come before us. If you don't plan to come here immediately, I beg of you to write as an only brother write to Rev. Srjan Mita Orlic & [...] you know before the election for Jovo. Jovo already sent in his petition. I know that Niko wrote about this, that is why please see that Gospic people win-I grew up there-why should a Geno Ilic be first ahead of Jovo, who is in Gospic. Little Niko is not taking it lightly and wrote immediately and they will listen to you. Come if it is at all possible during May and June when the weather is most comfortable.

I send you the best from all and papa who cries when you are mentioned; once more a kiss in spirit.

Your Sister Angelina

1. word is marrie
- 2 redrawn
- 3 redrawn
- 4 redrawn

# 20

PAGE 32

Milka Glunicic to Nikola Tesla  
(Tesla's sister)

No date or place

Dear Nikola!

We received your telegrand and it made us very happy-like there was no end to it. We could not understand anything for the longest time. Mother is well and so is the little girl. Did you receive the wine from Uncle Trivan? Since Uncle Petar left, we feel very lonely at home. Mother asks if you can send some money, because she needs it now. Vujo is ill for six months now which caused us to owe Trkulja money.

In the hope that you come again, Mother sends many greetings. I and the little girl remain most grateful until death.

Yours Milka

PS forgive my poor handwriting.



Rev. Nikodim(Niko) Kesanovic to N. Tesla  
Tesla's Brother-in-Law

Plaski, Lika  
Dec. 2, 1891

Dear Nikola!

Firstly, I want to say that mother in Gospic is well and so is Milka and thank God, all are well. Marica, compared to last year, has completely recovered. The baths helped her considerably last year.

As you know already from the newspaper 'Srbobran', uncle Petar became a monk in Gomirje. We were almost positive that he would become Bishop-but we were fooled. The Synod elected a certain Grigic for our Bishop. He is a man about 30 years of age. He went to the Seminary with my Sava at the same time. He is from Ganja. His uncle was an Archbishop. One day he left Gomirje for Karlovac as an Archbishop. Now, we think again that he will go to Tuzla(Bosnia) soon as a Metropolitan. In Gospic in uncle's place I assumed that it was ordered by the Consistory on Administration. But Very Rev. Trbojevic, who wants to be in Gospic made a protest to the Patriarch to stop my transfer until the next meeting of the Sabor which will take place most likely next Spring. Until pretending legally the selection, the Archpriest will be transferred to Gospic or remain in Medak. Now the Administrator for Gospic is Lalic and my brother Stevo who is the chaplain in Smiljan. Jovo Trbojevic wants the Gospic assignment and both are angry at us for my asking for Gospic. I did this only on the expressed wish of mother and uncle and said it was my wish that I go to Gospic.

Mother still lives in the parish home and I will move there in spring/2/ if God wills into be elected by Gospic parishioners. Then I will go home immediately. All the intelligentsia are with me.

Iso Vujinovic passed away a few days ago and left 1,200 Forints for the establishment of a Serbian school in Gospic. Now, he is praised in the newspapers as a valuable Serb. Simo Majstorovic received a stipend and went to the Cernovic Seminary. He wants to be a monk. (page 34) There in February he will come to Zagreb to try the III Rigorozum exams and hopes to be accredited with a Doctor of Laws degree(auspiciis imperatoris) which no one has passed at Zagreb University. He is a fine lad only if his health holds up.

Vujo Glumicic was not very well last summer, but now he regained his health. Uncle Pajo(Pavle) became "Oberstar 1 NOB. Milan was his jurist in Budapest. Simo Majstorovic's brother entered the monastery in Karlovac. Uros, a monk 'consistor' is our or scribe defrocked himself i.e. removed his mantilla, is now in Ogulin practising for a government job. His place as scribe 'consistor' was taken by my Sava.

Among those things of yours that you have written me about and those English newspapers, I wrote immediately to mother to make her happy. I sent those papers to 'Srbobran' (1) and the editor wrote back that he didn't print them yet in Belgrade so the the Serbian Gov't wants to peruse them in order to give you a ST. SAVA medal for scientific achievements and we shall let you know.

Journalism has seemed to go awry, especially in Croatia. They denigrate us Serbs a lot. They call us 'Vlasi'(nakot) "swine herd" and morally corrupt and the devil knows what else they have baptized us.

Please tell us how you are living and how is your work. All of us send greetings on your patron saint day St. Nicholas. Be healthy and happy and long may you live. We are proud of you and not only the Serbs, but, all of us. I Salute you,  
Nikoladin

P.S. We still don't have snow. -Weather is warm! Summer was nice. Marica will write to you. Now, she is making sausages with eh butcher with a good Dalmatian. Write to uncle Trvun.

1) added

2) " 3) added 4) written on edge of text veritcally.



Mjegovan, Vladimir. NIKOLA TESLA - HEROJ TEHNIKE  
Prosvjeta, Zagreb, 1950. Pp. 54.

Page 29:

(Narrative previously, p.28, says that Tesla, after his lectures in London and Paris, visited Gospić to see his ailing mother, who died in his arms.)

This letter (Gospić), April 21, 1892, "in black border" is a reply to one received from one of the mother's brothers. It expresses his grief, despite the fact that he foresaw his mother's death, for, considering her general vigor, he hoped she would still live long. -- He is sorry they could not meet 2 years ago when he had come to Slavonia, and will inform him when such a meeting can be arranged.

3



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE

Marica Kosanovic to N. Tesla  
sister

Plaski, Lika  
June 12, 1892

Dear Nikola!

I wrote you a few days ago and now I found myself remembering your birthday to congratulate you.

I have nothing to say only that God grants you good health and that you live well which gives us pride that you benefit humankind. May you live long! Milka wrote me yesterday and says that she has two suitors. One, Rade Mandic whom you already know and some official who happens to be Catholic. She would like the latter one and uncle Petar would not allow it, because, he is a Croat. His name is Barkovic,

Uncle writes to me often even though he is very busy. It is said that he could become a (stramac) with the priest's hair and beard, while he said something.

Everyone is well now. I am concerned about you that you work night and day. Now, you are busier because of the exhibition.

If you can write two or three words saying that you are well. How comfortable it would make me. Then, I would remove some of my worries. Wishing you the best of health.

Love you in Spirit., Your Thankful Marica

(Stramac) Tr. note- officer's bearing and posture. German word originally.



#24

PAGE 38

Milka Glumicic to N. Tesla  
sister

Gracac, Lika  
May 5, 1892

Dear Nikola You told me to write, and here I wrote immediately. I am very well and so is the little girl. It is very nice here, in fact I am enjoying it. Thanks to you since you had interceded to the good Aunt initiated the move, it is like heaven.

My little girl is going to school and Mr. Peinovic is her teacher. Domestic matters like sewing, embroidering, etc. is being taught by Mrs. Lemaic.

How is Marica and the others? Now I have no more to write. Aunt sends her greetings and the others. See that you give me what you had promised. I am in dire need of it..

Be Carressed well,

From your sister, Milka.



# 26

PAGE 40

Marica Tesla to Nikola Tesla  
Tesla's sister

Plaski, Lika  
December 4, 1892

Dear Brother!

Your telegram electrified me somewhat; one, that it made me happy; the other is that why didn't you write. Forgive me please, we were waiting however for you to write a few words, but now we did not have to wait-the letter would have found you even with an incorrect address, Thanks to heaven above all for the money you had sent in July and I shall tell you for what we had used it. My health has improved and moreover my teeth were repaired. Nobody wrote you about a copy of the Times newspaper and I know that it pleased you and I would write often and long letters if I didn't have the children.

I think that Niko (Rev. Kosanovic) prepared for Glumicic's death and you wouldn't care too much. I think that in a nice way Milka was liberated. She writes to me about this- I see that she feels sorry for him however. Angelina and Jovo were here recently. They are all well; little is not in Gospić anymore but in Novi Sad.

Simo wrote you and said how he brilliantly passed his doctoral exams. I know he wrote you about this and about uncle. We are justly proud and enjoy it dear brother that the calendars have your picture. In Bosnia the people honor uncle now that he successfully received his doctorate -Ah, God grant all good health. If we can get Milka a new replacement tooth so that she can enjoy life and live comfortably..

I cannot express how nice it is to read such good news. I do not know anything but learned by memory (these are my thoughts) -your reception upon arrival written in a Belgrade Serbian paper I memorized by heart, so if I am evil minded I only

PAGE 41

Whatever I read myself is only meant well. All of us are well. The children always mention you. Zmilun says that you will bring a whip (leather) that will reach from the ground to the bell tower and Dragisa says that you will get him an iron one.

This is so helpful to me, when I mention this they are so good. Will write to you often, and you be good and write at least once in a while

Wishing you good health *I kiss your soul, Your Sister Marica*



# 28

TESLA'S CORRESPONDENCE WITH RELATIVES  
TRANSLATOR NICHOLAS KOSANOVICH  
PAGE 43

Nikola Tesla to Sima Majstorovic

New York, NY

Tesla's First Cousin

Jan 2, 1893

Dear Brother Simo: (1)

I received your letter a few days after I came back from Pittsburgh where I had some work to do. I am working to have them accept my system of motors for long distance transmission at Niagara which they are discussing and I am hopeful that they accept it.

I don't know if I should be happy or sad about what you write to me. I never imagined that you would pass with honors the doctoral exams; take care of your health. If you are careful about yourself and after these tremendous efforts, I can attest that you will become completely well. One, youth is on your side and the other was that I was ill at your age and it was worse for me that you.

I was very sad from your letter that our unlucky one had passed away. He began badly and finished worse! I am more saddened that Milka doesn't have enough character and spirit that at least for a short period of time she controls the situation. She could become a good domestic and see better days and I would help her. There are events here that are promising and if they happen I shall let you know in a few months.

It makes me sad that Smiljana is ill. You know that she was always weak and it takes very little to knock her down.

Not a word from uncle, even though, we promised and said that we shall write often. I began like a man, wrote two letters and two telegrams and now I am writing and uncle shamed himself before God. I will attempt to write once more and then goodbye, Uncle Metropolitan.

I have two pieces of news for you, One: I was elected to the British Royal Society(when you write the next time, and you

PAGE 44

scribble M.R.I that means member of the Royal Society. Secondly: I received my first AWARD from the Institute of Electrical Engineers-a society of English engineers for my latest work. It is a prestigious award, I believe because, it is a first award given to an AMERICAN and who knows the English, one can wonder. Besides myself, I believe there is one other American who is a member. (translator's note-Tesla was 36 then)

I am working on a few inventions, if successful, will have transformed engineering. The experiments are very good and I am feverishly working. Since this I have been invited to the Inventors Congress at the next Exhibition(Chicago Columbia Exhibition). In February I will lecture to the highest group in electricity-that is the-Franklin Institute and the second lecture will be before engineers in St. Louis. At the inventors congress you will see my ideas.

Most generous greetings to Marica and Penja, Your Brother, Nikola



# 29

Tesla's Correspondence with Relatives PAGE 45

Milka Glumicic to Nikola Tesla  
Tesla's sister

Gracac, Lika  
Feb. 10, 1893

Dear Nikola!

I feel very sad that you wrote to everyone but me. Through the other letters I see that you inquire about me and you are concerned about my behavior. Firstly, so you do not concern yourself about my behavior, now I am a completely different woman since that heavy burden was removed from my shoulders and the burden was Vujo. I was completely confused at that time fearing to say anything bad or do something bad to someone. In that despair I made a mistake perhaps, but not any more! Now I tell you from my heart that one can peacefully; do not be concerned about me

It is fine for me here, only for your dear I must correct myself and you don't know how it is to be in other people's homes, but it has to be that way. Our house is full of people and it is even overcrowded. Only if I had a separate room, it would be much more comfortable.

Pajo is here and he intends to marry, how will it be then? Auntie became ill again-her old illness is coming back. I beg of you to send some money for the child's clothes. I am also looking for work; maybe in a small school. The child is repeating her grade; if I was in Gospic, I would go to a high school(girl's). Diphtheria is endemic here. Bettina's two older girls died. Write when you can, even Auntie wonders why you don't write to me. Now I have completed this letter and hope you are happy. Simo is coming here.

With God, Your Milka



*March*  
P.35. On ~~May~~ 13, 1895, there was a big fire in Tesla's laboratory in New York, which destroyed not only all his apparatus but everything that was of historical and of similar interest for Tesla's work. This fire caused tremendous and irreparable loss to Tesla. Only his unusual nature enabled him to survive it. In an interview to the Electrical Review, Tesla said:

"Everything is lost, not only what had importance for new works; more, and all that had personal value."

The Sun wrote:

"The downfall of Tesla's laboratory in New York is a misfortune for the whole world. It is not an exaggeration to say that there is not a more important person for mankind today than this young man."

This and similar expressions gave Tesla the moral support to begin the construction of a new laboratory, which began functioning in 1896.

(Abstracts of letters and translation by Mary Molek, Immigrant Archives, June, 1965)



Challenged Prof. Ehieme Thomas to a showdown.

Marconi at his early date →

→



# 30

TESLA'S CORRESPONDENCE WITH RELATIVES

PAGE 46

March 14, 1893

Dear Nikola ~~Your~~!

Your precious letter, however it is [...] written pleased me very much. I know with all of your work it isn't just babble scribbling. Write a letter to me and Niko and most of all tell us about your health. I reported immediately to you about Milka-to tell you the truth, it is rare that I say anything about her. It is incredible that Milka has changed completely[...] they tell me someone Vujp died. (her late husband). She writes to me often and I in what ability I have that work can bring her back to serious life. Her letters are very intelligent, even though, ten percent is otherwise and we should be calm.

Certainly I would like her to be with me or at Angelina's. She would be closer and then I would be prepared to accept all responsibility.

Don't worry I shall write often and to Aunt and Uncle Trivun often; I think the more often the better! I will send some goods that I think she might need, but, I think she has enough clothes. Meanwhile, you do not worry at all. I asked Angelina to write to her often. We read about you in a Dalmatian paper "DUBROVNIK". As much as I enjoy reading about it I know all of the effort that is required by you. I know that you do not find effort as a sacrifice. I shall pray to God to give you good health. I don't know in my nervousness if I had something else to say. I cry from time to time.

All the relatives are fine all around us. They send you greetings.  
WISHING YOU GOOD HEALTH.

page 47

Love you in spirit, Your sister, Marica.

page 48 # 31

Nikola to Simo Majstorovic

New York, N.Y.  
May 17, 1893

Dear Simo:

In your last letter you mentioned that you will write again and I anticipated some word from you. I heard from Uncle Petar and Marica that all are well but but would like to hear from you; I brother, have challenged Professor Thomson to a showdown. I can explain it best by saying the result of Marconi's words, "Woe to me dear god to lose oneself better than his own." Let it be for the best; From now on whoever intends to attack me will have to rethink again everything.

I feel that life is difficult more and more and cannot complain about one's health. In addition to all of my work I am going to write a book. It is going to be unusual-unusually evil.

I intend to announce various apparatus experiments and ideas that are going through my head for some years work. I am compiled practically everything from what I have read in magazines and are to be new. It can hurt me or possibly help me. My ambition is to come out not as a technician but as an inventor. ~~PAGE 48~~

Write to me as soon as you can. I am anxious to know about you and your health. Say hello to all of those at home, mother, Milka, and the others, the same for all the relatives & friends.  
YOUR NIKOLA ADDRESS: ASTOR HOUSE  
P.S. I sent mother 100 Forints about the first of the month.



## TESLA'S CORRESPONDENCE WITH RELATIVES

PAGE 49

Marica Kosanovic to N. Tesla  
sister

Plaski, Lika  
Oct. 2, 1893

Dear Nikola!

We read in the Serbian papers today translated from the English papers of your about your recent lecture in Chicago. They write about how you looked; they say you are very thin and your eyes are inflamed. A man who was eating lunch with you said to him that you do not look well and that your voice could be hardly heard across the table. I was afraid that you are overextending yourself. It would be best that you come here- a little time at Uncle's with us, then in Petrovo Selo so that you regain your health; then you could continue your work.

Here you can enjoy the clean and beautiful air and go hunting which was always a great joy for you. This would strengthen you. You would have good company for the hunt. It is evident how sweet it would be to enjoy meals; I think that you would not have to drink boiled water here- come, dear brother, make a decision and come while the weather is good for travelling- don't take your youth lightly and accept your sisterly request.

All of us are well- Milka got married; this you may have heard from Petrovo Selo. Please write to her and make her happy. They say he is a good man even if it is not the best arrangement. One cannot predict; one must say that it is many degrees a better match than before. Love you in Spirit.

Your Grateful sister, Marica

\P>S> All send greeting and want you to relax as I have written. (1)

1) Written on the left side vertically on text.



# 3 2

TESLA' CORRESPONDENCE WITH RELATIVES  
PAGE 50

Nikola Tesla to Pajo Mandic  
Tesla's Uncle

The Gerlach Strictly Fireproof  
Hotel, N.Y. Oct 20, 1893

Dear Uncle:

I received your letter of September 25 two or three days ago and I found time today to answer in a few words.

I was pleased that you left the service and decided on a peaceful life with your family. It was a good decision for you and it looks like there will be trouble out there and you are not a young man, even though, you feel young. I would be immeasurably happy if you come here to see the Chicago Exhibition; Petar advised you well, because, here was a large number of unsure roads and collisions on the railroads daily and financial panics that America has not seen until now. Now, everything looks better and improvement will continue. It will take two or three years for the wounds that plague industry and a belief back to normal. I have much to tell you. I lectured before a scientific congress on the advice of many acquaintances and showed the inventions that I am working on now. They are new steam and electrical machines which I anticipate to be successful. Also with my motors along with bankruptcy of a company here and a general financial weakness there were very little demand.

PAGE 51

and now they will be used more and more and the outlook looks good. If there is success here, then my inventions will be needed at the Exposition. IT LOOKS MACHINES OF MY SYSTEM WILL BE USED IN THE TRANSMISSION OF POWER FROM NIAGARA FALLS. I will be able to tell you shortly. In the main, it looks like many of my ideas will be utilized in this gigantic project. If it is successful, there will be enough money. I think then I could help my relatives. I have been acclaimed more than anyone in my discipline; that is what they tell me. I received awards after awards and that makes me push ahead. There are always ideas before my eyes. If I could develop one for practical use, the whole world will feel it. I am in good health; the worse is that there is no good wine here. I would gladly pay if I can get some in small bottles; large bottles are inconvenient, because, I drink a little-quality more than quantity.

) emphasis  
not in  
original

I am happy that all are well and that Simo is well. Give my warmest greetings to all and mention me to uncle Pero, uncle Vaso and the other relatives, especially your family.

Your Nephew, Nikola  
P.S. Colonel Djuro Canic was here. He knows you.



Page 29: To Col. Pajo Mandic (care of Hon. Peter Lupa, Esq.) Pazar, Budapest,  
Hungary, Europe.

Written at The Gerlach, Strictly Fire Proof Family Hotel, 27th St.  
between Broadway and 6th Ave., N.Y. N.Y. Oct. 20, 1893.

Dear Uncle:

(Was glad to hear of his uncle's retirement; would have been happy for him to have visited the Chicago Exposition, but "Uncle Peter" had given good advice about the uncertainty of the transportation because of daily train accidents; and again a financial panic such as America had not seen. Things look better now but it will take 2 or 3 more days before the heavy wounds suffered by industry are healed. He has much he could report. At the request of many scientists he lectured before the Science Congress at which he showed the inventions he was currently working on. These are now steam and electric machines, from which he expected great successes. The same is true of his motors, which, because of the bankruptcy of a certain company and poor financial standing, were put to small use; now they are in use and the prospect is very good. If it succeeds, then his invention will be used there. It appears that his system of machinery could be used in the transfer of power at Niagara. In the main, it looks as though some of his ideas will be used in this gigantic project. Were this to happen, he would earn much money; he is not thinking of this, but he would like to help his relatives. It appears to him that he has achieved greater fame than anyone else in his profession; he has received one honor after another, and this encourages him and spurs him on. He envisages that if he could develop only one (thing) practical, the entire world would be affected. -- His health is good. Most of all one misses good wine. He would like to pay well if he could get it in small bottles, since large bottles are inconvenient; he doesn't drink much. "Quality and not quantity."

Regards to family -- good wishes. Your nephew, Nikola.)

\* \* \*



Page two - Nikola Tesla letters

Address: unknown

Letterhead on the paper, as above.

New York, Nov 11, 1893

Dear Uncle:

(He writes only briefly and hurriedly, being greatly occupied by a task. But, God willing, he hopes to see him in a few months. Now he has just completed a new invention over which he is elated. The success is wonderful in every way except monetary. But this is bound to come. If he had enough money to be independent, he could acquire a large possession. In the present situation that he finds himself he will have to take what he gets.)

(There are references to Simo, of Milan, and apparently some ill health where Simo is concerned. He expresses regrets at the uncle's discontent. He (Tesla) had given him advice beforehand. I hurriedly, Your Nikola.)

\* \* \*



# 34

TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 52

N. Tesla to Pajo Mandic  
Tesla's uncle

New York, NY  
Nov 30, 1893

The Gerlach strictly Fireproof Family Hotel  
27th St., Between Broadway 1& 6th Ave

Dear Uncle:

I received your letter and it made me very happy even though some of the news could have been better. I haven't time to write an extended letter, just to let you know that I am fairly healthy now. However if God wills it we shall see each other in a few months. I just completed a new invention that is great! Success is wonderful in every aspect except money. That will also be soon. If I had enough money to maintain myself, I would have achieved greater success and fame. I find myself in a situation before hand I have to do the best I can.

You write Serbian beautifully. I am afraid that Simo (or Milan) helped you! I am happy that Simo is well and I hope now that he will be completely cured. I am sorry that uncle is dissatisfied. I told him everything before hand. The best to all.

Your Nikola

# 35

PAGE 53

Marica Kosanovic to N. Tesla  
sister

Plaski, Lika  
Dec 5, 1994 3

Dear Nikola!

Happy Name Day and all wishes are of the biggest: God gave you good health! I receive you letter and thank you very much that our conversations are not what that reporter wrote. We are pleased that you are coming. How much shall we see of you-so long as your rest. Everything is normal here. I am well at times and ill at times and in this way monotony is broken. Those in Petrovo Selo are in fairly good health. Angelina was a little from her summer birth and now is completely well. All of my letters are in one drawer and they can be published.

Pajo from Aunt Smiljana got married recently and will now become ordained. Simo nor uncle will ever write to us; you will know more about them than we.

In conclusion, I wish you the best on you Name Day and love you in spirit.

I am,

Your thankful sister, Marica.

translator's note: St. Nicholas Day in the Julian Calendar which the Orthodox Church observes falls on December 19. (Sveti Nikola) This is the traditional day instead of birthday observances..

An Orthodox priest can marry prior to being ordained.



P.31: To Rt. Rev. Nikola Mandić, Metropolitan, D. Gzila, Bosnia, Austro Hung.,  
Europe.  
From Nikola Tesla, 35 South Fifth Avenue, New York, Dec. 8, 1893.

(First paragraph: comment on exchange of letters between them.)

(Second paragraph: Says that his system of machinery illuminated the Exposition; his inventions received the most interesting reactions there; and, as he had stated, his system was being used at Niagara. These are: a new system of steam power machinery for the conduction of electricity. His lecture created an indescribable impression. It would be difficult to convey how esteemed he was in the scientific world today. He has received many letters from the highest men (in the field) recommending that he modify (perhaps, lessen) his work. For there are plenty of scholarly (?) people but a small number of those with ideas. This, instead of diverting him from work, creates further enthusiasm. He expresses his feelings on the day he received an autographed photograph, "From Edison to Tesla.")

(He is working night and day on something that he feels will be of incalculable value to mankind, but he is afraid his powers will fade before he finishes it; this is something difficult for him to explain) (It is rather vague as to which part of his statement he is referring here. M.M.)

(A book is being published, describing his collected works. This was assembled by one of the leading writers in the technical field. The book is dedicated to his countryman. The uncle will receive a copy, but, unfortunately, it is in English.)

(Family greetings and congratulations "on your success." Your nephew, Nikola.)



# 36

Tesla's Correspondence With Relatives-Tesla Museum-Translator English text  
Nicholas Kosanovich PAGE 54 of 65

Tesla to Petar Mandic  
Tesla's uncle

New York, NY  
Dec/8. 1893

from N. Tesla  
35 South Fifth Ave  
Right Rev. Nikola Mandic, Metropolitan  
D. Tuzla, Bosnia, Austro Hung. Empire

Dear Uncle,

The letter of yours that I have waited for a long time finally arrived today. You do not remember that I wrote you twice on leaving London and sent a telegram and you promised to write when you find time. These are all small matters. I received again two letters from Simo and he promised that you would write when you have the time.

Since I arrived I had achieved many successes. My machines enlightened the exhibition. (Columbia Exposition, Chicago). My inventions to say the least were the most interesting echo at the Exhibition and I told you that my system will be used at Niagara Falls at the Congress of Inventors in Chicago. I delivered lectures about my latest work. They are machines of a new steam system to produce electricity. My lectures caused an inexplicable impression.

It is difficult to give you an idea how I am respected here in the scientific community. I received many letters from some of the greatest minds, proposing that I stay the course, because, they say that there are enough educated men but a small number who have ideas. Instead of them taking me away from my work, they inspire me. I received many awards and there will be more. Think how things are that I recently received a photograph of Edison with inscription-"to Tesla from Edison."

I am working night and day now on my machines which I hope will be utilized. If I live through this; there is no doubt I will achieve fame. This does not interest me. It seems to me that I found something of immeasurable value for mankind and I am afraid that my energy will be given out before I complete something.

There is a book here to be published in which my collected works will be written. This is by one of the best writers in the technical field. He dedicates this to my countrymen. You will get a copy; sorry, it will be in English text.

You don't know how happy this makes me that Simo is well again and everyone is in fairly good health.

The Best of Greetings, Your Nephew, Nikola

P.S. I congratulate you on your success. I know how difficult it was with the people and government.

) emphasis  
not in  
original



Page three - Nikola Tesla letters

P.33; Address; Unknown

From: The Garlach (as above) N.Y., Jan.23, 1894.

Dear Uncle:

(He comments upon not having time to write, then states that the wine presumably sent to the uncle - which he is awaiting as "the Jews (await) the Messiah" has not reached him yet.)

(He has much news. His system is being used at Niagara. His new invention, called "oscillator" is progressing splendidly and the entire outlook is good. As concerning the "machinery", ie, the physical health: it is not exactly Miloš's, but it could be worse. (This allusion is undoubtedly alluding to the health of a friend or family member).)

(He hopes that the influenza has not been harmful. The Americans do not worry about such things as the influenza. They take a large glass of whiskey, dissolve from 10 to 20 grams of quinine in it, then go to bed, sleep, and in the morning they are as well as a steel ingot. Try this and you will see you will not have influenza.)

[ (Does not have time to write to Maria.)

(He has sent the book describing his works. He has sent a copy to every sister and uncle. The book is enjoying success and is in the second edition.)

(He is hoping to see them on a business trip to Europe. All his doctors and friends are advising him to stop working, but this is difficult for him until his work is finished.)

\* \* \*



# 37

Tesla's Correspondence with Relatives- page 56- translator Nicholas Kosanovich

Nikola To Pajo Mandic  
Tesla's uncle

New York, NY  
Jan 23, 1894

letterhead: The Gerlach Strictly Fireproof Hotel  
27th St., Between Broadway & 6th Ave.  
Charles A. Gerlach, Prop.

Dear Uncle,

I couldn't answer your letter that I received a few days ago and now, I have a few hours only and want to show a good example to my uncle; and with this to enlighten me for the advice that you have given me before and I realize it. This is "veritas", but it isn't "in vino" because the wine I am waiting from you which is like "Jewish message" (waiting for the Messiah) and did not arrive.

In general I have good news to tell you. My system is being used at Niagara Falls; probably uncle Petar told you, because, I told him by wire. My new invention which is called an "oscillator" is progressing well and looks most beautiful. To mention machinery my body condition is not the best but it could be worse.

I hope that influenza did not debilitate you. Americans do not worry about such bagatelles as influenza. They take a large glass of brandy to melt it and 10 to 20 grams of quinine and then to bed and fall asleep and in the morning they are healthy as steel. Try it and you shall see there is no influenza.

I would like to write to Marica, but, don't have the time. I sent you a book in which my collected works are written. I sent each sister and uncle a copy. My writings were collected

PAGE 57

by an American writer who is very successful. There is a **second printing already.**

**I hope that I will be in Europe soon and will be able to visit you.** All my friends and doctors say to get away from work and that I rest, but, it is difficult because my work is not finished.

Greetings to you and the warmest,

Your Nikola



#38

TESLA'S CORRESPONDENCE WITH RELATIVES TRANSLATOR N. KOSANOVICH  
PAGE 58

Marica Kosanovich to N. Tesla  
Tesla's sister

Plaski, Lika  
March 3, 1894

Dear Brother!

Received your letter where normally from happiness I cry, this time it made me sad. I am sorry that I cannot express, what all that we should your countenance-I don't know how it is with others, I know how it is with me and Niko- something most holy, to receive your letter and to reply, because you are so occupied with your work and burden, I am afraid that this will bore you with what we have to say. We received that book and later that magazine that you had mentioned. We immediately sent the book to the editor of the newspaper "Srbobran" in Zagreb and they immediately wrote how the Serbs enjoy -one abroad of the great name of Tesla and how wouldn't the relatives enjoy this success.

One day we also sent the magazine, and we hope that this too will be translated into Serbian by Srbobran.

Here, I am sending you a picture, only the one that is by us by chance. I think that you will be happy with the editor, this is the home where your mother had lived and where she had died, and what is to become of it-what is more, one can see the high school where you had spent three years.

Nikodim sent the pictures and the literary works where they should go immediately to this editor, and to send you literary books as soon as we get them. There is a committee in Zagreb that concerns itself with the cleaning up of and beautifying the "Plitvice Lakes" and Niko wrote to him immediately where he feels that he can get the best pictures postcards from our most beautiful areas. It can be that he sends it directly to you or we can send them also..

About the literary works, I think that you have what is the best. We feel that you will like them-like Cengic (Death of Smail Aga Cengic) by Mazuranic.

PAGE 59

Also "The Mountain Wreath (Gorski Vjenac) by Njegos-Jovan Jovanovic Zmaj's poetry, Vojislav Ilic (who died recently in Belgrade), a poet at a higher level than Zmaj etc. That which Niko thinks you do not have, he picked them out and had them sent to you. You will receive them shortly.

Here, everything is as it was before-old-way like always, sometimes I lay down;, and sometimes I think that I am healthy and strong. All of the others are healthy (well). Angelina and Jovo have revived themselves, and thank God (for now) you have another niece. Milka is well like a Lynx, that is why she is militarily behaving like Don Quixote. I hope that they come here, they promised to come soon. Jovo was honored by the Bishop with "Church cumberbund.. This made us all happy. Uncle Petar is writing and complaining to us that it is difficult for him. I am sorry that things don't go as they should. I am not too well and if it were not so, I as old as I am would learn the English language just to know what strangers are writing and saying about you!. Believe it or not, I learned French fairly well and read it with a great deal of comprehension.-only we do not have French books. When I was in Rijeka, I learned quite a bit of Italian, this winter I study English but to no avail]. This letter is quite long and I am afraid that you will complain that your time is consumed by my long letters. Accept my warm greeting all of us, who are anticipating your arrival I just like the waiting for Christ, from your thankful Sister,  
Marica



P.S4: To Hon. Colonel Paul Mandić (E.K. Oherst)  
Warasdin Hungary Europe  
From: The Gerlach (as above)  
New York, April 13, 1894

Dear Uncle:

(Writes briefly, only to inform that there is still no wine, so that all the bottles sent by him - i. e., this Uncle - and those sent by Uncle Trivun must have broken. - Do not send me Dalmatian (wine) in the small barrels; I have experimented with this and it does not go. The only way would be to send Magyar wine in bottles. - Not long ago he got a gold medal from Franklin Institute for his accomplishments; some university has offered him a Doctor of Philosophy degree. He knows this will interest him. Everything looks fine now. He is progressing well with some invention and he hopes to finish it soon so that he can take a rest.)

(Greetings from Your Nikola.)



# 39

TESLA'S CORRESPONDENCE WITH RELATIVES-TRANS. NICHOLAS KOSANOVICH  
PAGE 60

Nikola Tesla to Pajo Mandic  
Tesla's uncle

New York, NY  
April 13, 1894

(Letterhead)  
The Gerlach, Strictly Fire Proof Family Hotel  
27th St. Between Broadway & 6th Ave.  
Charles A. Gerlach, Proprietor.

Dear Uncle,

Your two letters came on time and I could not reply due to a lot of work. I find time now to write only a few words that are pressing. There is nothing about the wine now, as you had said those bottles you sent and those by Uncle Trifun must have been broken. Don't send me "Dalmatina" in a barrel, I had experimented with this already and it is not good. A solution would be to send Hungarian wine in bottles.

Recently I received a medal from the **Franklin Institute- a gold medal for scientific achievements**. It seems to me that I also wrote before that a University is awarding me an Honorary Ph.D.. I know this will interest you. Everything here is fine. I have succeeded with a few inventions and hope to complete my work shortly then I intend to go there-just if I rest it will be a help. Greetings to all your  
Nikola



# 4/3

TESLA'S CORRESPONDENCE WITH RELATIVES, TRANS. NICHOLAS KOSANOVICH  
PAGE 61

Marica to N. Tesla  
Tesla's sister

Plaski, Lika  
April 22, 1894

Dear Nikola!

Yesterday I was happy about your letter like the sun being frozen, because I was concerned about your health, after so much tedious work and effort[...] must take its toll. I am well now, and now I feel alive and I will be just of 40 years of age. Now I go outside and do chores around the house; only as much as I am able to do. Since I broke away from the bed I hope that I will improve with time. I was in bed seven weeks, and it really became a way of life, but, now all is well now.

Everyone here is in good health-Angelina & Jovo wrote to me immediately about your great success. If only God gives you good health-this is the only thing that I have to pray for. Jovo's letter made me so happy and gave me strength than[...] (nihaliranje). You say that boiled water helps you; I would try it, but, you didn't say it it should be drunk hot.

Milka wrote to me recently, and she says that she is not that other Milka. She changed completely-firstly, she was like a desperate woman, but in desperation, she had to work incessantly to forget her situation. Now she feels differently. Simo went a short time ago to chemovic. We hear that he is well now. Uncle wrote to us recently. It seems to me that he again has financial trouble and again with you his relationship is worse. Woe to me that I cannot help him. All of that was in the way and I hurried to reply to him.

I salute you on your name day and hope that I am not too late, lika a name day. I don't know what to hope for you now that you are successful. I do hope for your good health, and would write more, but I know that you had enough. Good luck dear brother, a with you

PAGE 62

great, glory and happiness-to each his own, Angelina was here fifteen days and took with her Seja. We read in JAVOR "Excerpt from a larger work" "Nikola Tesla and his discoveries" wrote Stanojevic. It was written beautifully and well. Niko is in Rijeka and I know he wrote to you. Accept Greetings from all in Plaski.  
Love you in Spirit, Sister Marica



Page four - Nikola Tesla letters

P. 34. Address of person to whom writing not given.

New York, May 17, 1894

Dear Uncle:

(He is answering to his and Maria's letters hurriedly, for time is precious.)

(Don't worry about the wine. - He got hold of something similar, - some French brand, not as good, but it could be worse.)

(He intends to go there soon, and it would please him if the Uncle were in Pomaz so that he could visit him.)

(He will send the Perl book (Perry?) some day, and is sending an issue of the large magazine, Century, which has some translations of Zmaj's poetry. - By this success I judge that Serbia profited more by these articles than from my work in the field of electricity. (I am not clear whether this means that he translated the poems, for he uses "article" in the second part of the sentence. M.M.)

(He is progressing well, and one new machine for illumination is now in readiness. He hopes for much success when this will be put into operation.)

[ (Family greetings. - "I would write to Maria, but I cannot bring myself to enter into correspondence with ladies.") Your Nikola.

\* \* \*



#39

TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 60 TRANS. N. KOSANOVIC  
Nikola Tesla to Pajo Mandic  
Tesla's uncle

New York, NY  
April 13, 1894

Dear Uncle:

I received both of your letters in order and on time but I didn't have time to answer due to being very busy. I want to take with this situation to reply to some of data in your letters.

About the wine there is nothing until now, however as you had said all the bottles and those that uncle Trivun had sent must have been all broken. Do not send 'dalmatin' wine in a barrel. I had experimented with that and it does not go. The only way is to send Hungarian wine in bottles. Here I received a few days ago from the Franklin Institute a Gold medal for scientific services, and it seems to me that I wrote to you about this and a University is going to give me an Honorary Ph.D. in Science. I know this interests you. Everything is going well here. I am now preparing to go there after I complete some new inventions so that I can rest. Greetings of the warmest to all, Your Nikola.

PAGE 64 # 42

Nikola To Pajo Mandic

New York, NY, USA

May 17. 1894

letterhead:

The Gerlach Strictly Fire-Proof Hotel.  
27th St., Between Broadway & 6th Ave.

Dear Uncle,

I received your letter and Marica's today and here with a few words to answer you, because, time is precious. Do not concern yourself with the wine, I uncorked some good wine here. It is a French wine and it is not good but will suffice.

I intend shortly and it pleases me that I will visit you shortly.

(Seems too short for text of original)

repeat  
of  
page 60  
letter



page 171

Sava Kosanovic to N. Tesla  
Tesla's Nephew

New York, NY  
Dec 16, 1926

Hotel Navarre  
7th & 38th St. Rm 4405  
New York, NY

letterhead

Noble Uncle

I returned today from my tour of Serb colonies. I will go to Europe Dec. 23. I am at your disposal to accept me before departure.

Greetings, Your Nephew, Sava N. Kosanovic

page 172

Nikola Trbojevic to N. Tesla  
Tesla's Nephew

Paris, France  
Aug. 15, 1927

postcard:

Mr. Nikola Tesla, Pennsylvania Hotel, NY < NY USA

I am just starting for Berlin and Yugoslavia. Wish you were with me.

Yours Affectionately, Nikola Trbojevic

page 173

Nikola Trbojevic to N. Tesla

Berlin, Germany

POSTCARD

Mr. N. Tesla, PA Hotel, NY < USA

Arrived here from Paris O.K. in a Farman airplane. Will tell you all about it when I return.

Sincerely, Nikola Trbojevic

*copied & inserted at p. 171*



# 43

TESLA'S CORRESPONDENCE WITH RELATIVES-TRANS.-NICHOLAS KOSANOVICH  
PAGE 65

Marica Kosanovic to N. Tesla  
Tesla's sister

Plaski, Lika  
June 25, 1894

Dear Nikola!

I received your letter today and here I am answering immediately. First of all thank you for your brotherly nurturing me in my health, and your letter brought me to tears like the other letters up to now. I am well now for it. A donation is in order if you care to do so; but I thank you and you have nothing, but, I have a brigade of nephews. We read your article about the poet Zmaj translated in the newspaper "Srbobran". **God blessed you with this gift of how elegantly you wrote it! This is a contribution for Serbdom than a great number of works.**

⇒ Even the Croats have to pull in their horns. They cannot now say that you are a Croat, but they say everywhere 'our Licanin', our great countryman[....] We are happy that it is written about your arrival here, and I anticipate this with anxiety and fear. Uncle writes to us often, and he is content, what will Niko do in Rijeka if they force him into a pension.

Again you come up with another invention! Oh Dear God, what will become of you! I, brother, don't know anything about this and travel through Spain when I read about your inventions. Even who tried this it is very popular writing.

In Petrovo Selo, everyone is well. Milka always promises me that she will come, but, never does. I have hopes that when you come she and I will be together. My eyes have not seen her in eight years. My family is well; of my sons who is tough, they say he looks like uncle and the timid one is not. The oldest plays the harmonica and his teacher is (Uncle Sava). I just completed this letter, and you probably do not have the time to read it and now I close with greetings from all of us, and I kiss your soul.

Your Thankful Sister, Marica



# 44

TESLA'S CORRESPONDENCE WITH RELATIVES  
PAGE 66

Marica Kosanovic to N. Tesla  
Tesla's sister

Rijeka,  
December 6, 1894

Dear Nikola!

Her it is a few months have passed, and we live in hope, that you will come as you promised in you last letter. However we could have written you-no matter where it would be, but if we knew that you are not coming, we would not have not suffered as much. St. Nicholas day is coming and I can let it pass by without greeting you a happy name day even if you are on the other side of the earth. I wish you the bes on this day and let God give you good health.

A month ago we received those newspapers, that was sent to Plaski, Then I felt that you did not go to Europe.

In these times much has changed, mostly that we moved to Rijeka in August. There was all kinds of messing around and and we had to swallow a lot of dumpling sine we came here, but now all is wel, and Niko will be appointed as a permanent parish priest here. As of now it is hard to maintain lilfe here. One is that everything is expensive here and the other for such a large family the pay is small. But it will improve shortly with an increase in pay. Otherwise it is much better because il feel much better here. I do not have those fevers at all now. Everbody in Petrovo Selo is well; Milka's husband will be getting some kind of position in Gospic. Geno Ilic is was appointed there. Simo Majet was here for a few days and he is going to a small island nearby to pass the harsh winter. He coiughs much, for me I feel there is nothing worse and nothing looks any better for the last three years. I have hope that when he discontinues his temper tantrums, he will become healthy again. Uncle Petar is well and we hear that he wrote you thes last few days.

Page 67

We read about you in the newspapers, but, it is not clear to us, until we hear from you. Accept greetings fro all.

Love , Grateful sister Marica.



# 45

Tesla's Correspondence with Relatives page 68

Marica Kosanovic to N. Tesla  
Tesla's sister

Rijeka  
April 24, 1895

Dear Brother!

We received that book and thank you so much for remembering to send it.. In this we find no satisfaction! We are happy when we receive letters from you in your own handwriting. I am honestly completely defeated, and it is my one hope that in your big heart, that someone is not dictating to you[...] and you in a heroic manner, be a great spirit and that you do not acquiesce. I am now announcing something rare that you guard your health to get stronger. Reading from the newspapers that lately you have lost quite a bit of weight and I worry night and day that God grant you health so that you can achieve success more easily, and do not worry about regressing because you have arrived at the pinnacle of success i.e. if it is true what the newspapers write- Please I beg of you dear brother, -save your strength from day to day-so that such great efforts do not debilitate you..

Simo was here and he went to Plaski yesterday and then to Tuzla. He recovered fairly well. We are all well only sad and fearful. Wish you the best of health I am ,  
Thankful Sister, Marica

Rijeka was called Fiume then. It was under Italy.



Page 69 # 46  
Radivoj to N. Tesla  
Tesla's Brother-in Law

Skare near the Islands  
Sept 24, 1895

Our Dear Nikola!

On the Holiday of Aug. 18(Transfiguration) of this year, the gift of 100 Forints made us very happy when we received it.  
Thank you very much from me and Milka for this beautiful \* gift. We remember you and even in our sleep and also when we see your beautiful photo when we need inspiration,, like from one honest benefactor.; at the end of our giving credit and consolation , we pray to God that you remain healthy and live that you can succeed in your enterprise that the world world applauds.

Little Djurdjica is going to the VII grade in Gospic at the girls high school, and we used that 100 Forints for her and for Milka's needs in the home -a now we at least barely exist but satisfied. For my good Milka and little Gina, do not worry, they do not lack anything; we have enough of everything. These are my responsibilities. We have money that we loaned to people and the interest helps us live a little better.

I hope that the money due is paid up to January 1, then, I can purchase a fairly nice home and and an orchard and 8 jutars (1 jutar is 2 acres) of land for 2,500 Forints.

Milka and I like this property very much, and if we purchase it, then we will be useful property owners with my fairly good salary will be more secure that this property can be paid in 5 years.

This is the land of Kralj Gruntovinar Divak Nikola from Osijek. We are very happy with the location, because, it is in a beautiful area .

Wishing you health and the best of luck, greetings from your sister Milka ,

Yours to the grave thankful, Radivoj



# 47

Tesla Correspondence With Relatives  
PAGE 70

Pajo Mandic to N. Tesla  
Tesla's uncle

Pomaz, Aust. Hun.  
Jan 24, 1896

Dear Nikola!

Here it is almost a year past, and no letters, no word from You\*. I read quite a bit about your inventions and and I understood to be in awe at your great mind, like a wonder of an unknown and unseen; and this wonder I still cannot grasp. Your noble mind inspired us to worship you. A whole year with no letter.

A combination-what is the cause of this-double recognition.

To have You\* and Your\* brilliant future before your eyes, the most important wish in my contemporary simple life to follow that to write You\*, and in the name of our whole clan I beg that you write to us and that you are alive and well and that we have an opportunity to see you within a year, because your promise of last last year was not fulfilled.

In short, I shall let you know about us here.

Marica is always sick; her daughter had died, the pet of both parents passed away in December. Nikodim is well and also the other children.

Angelina and Jovo and the children are well. Petar's son received a scholarship stipend called the Tekelija\* award, and is studying in Budapest. We see each other often. He is good and considerate.

Milka and her son are well; the daughter goes to a girl's school in Gospic where Very Rev. Gena Ilic teaches. Majstorovic's nephew is well and Trifun and Petar are fine also. Marija and Mojo Majstorovic are well. Simo is with Petar in Tuzla, always sick, weak.

PAGE 71

Nikola, Mojin's other son married the daughter of Major Panjkovic and stays in Stikadi. Smilja Obradovic is the most unloved in her family; Pajo just about got the appointment in Nebulj; Milan studied in Zagreb and just about became pastor in Nebulj, and in the last year died in Zagreb. Jovica began to study at Sremci-Karlovc; corrected some crazy matters there and could not remain there; then sent him to the university in Zagreb to study more. The oldest two daughters of Smiljana are married, the oldest poorly, and the other to a priest and the youngest is terminally ill.

All of ours are well. Marija is betrothed to Lazo Ladjevic, a businessman from Zagreb. You will recognize him. He is the brother-in-law of Vladimir Matijevic. The wedding is in the beginning of May. Milan graduated with a Law degree from the University of Budapest and teaches now in Vienna Philosophy.

Please write immediately, so that we know about your well being.

All of your works were published in Germany. I bought a book for 8 Forints. **Srbobran will your print your work in a series and publish your lectures** that is if you agree. I am asking you about this.

Will you come to the **exhibit in Budapest?** All of us would be so happy and you could attend Marija's wedding! Petar, Trifun and Toma all promised to come.

I am waiting for your reply and in advance am happy. then we can talk about ours and be happy.



Please accept from all of us the warmest love and best of health.

Your uncle, Pajo



# 48

Tesla's Correspondence with relatives Tr. N. Kosanovich

PAGE 72

(Rev.) Nikodim Kosanovic  
Tesla's Brother-in-Law

Rijeka, Italy  
Feb. 3, 1896

Dear Nikola:

Last Fall in October we received from you a beautiful 'apple' of 265 Forints-6.11F in our money. We even did not expect this and like settling accounts let alone our appreciation. But forgive us, we had very difficult times.

You were thinking about sending that other money, that Marica go to a larer city, to a better doctor, to seek advice about her debilitated condition of health. But a few days ago, prior to getting the money, she fell ill and is in a hospital bed and was there for 5 or 6 days. Now, she is just able to get out of bed during the day. She still cannot go outside and ride, let alone take a walk. Her stomach, influenza, loss of appetite, some spitting of blood, that is what she suffered from and still does.

Moreso, during the course of her illness our little daughter Andjelina, that angel among children, in body and in spirit, passed away just before Christmas and we will always miss her. The doctor said that she had meningitis \....\.

This is what we were burdened with since autumn, -so you will not be angry at us, that we did not write to thank you for your apples and brotherly mercy toward your sister.

All are well in Petrovo Selo-Angelina with Jovo and the children and Milka also.

Everyone is well at uncle Pajo's; if you did not hear from others, Marija is getting married in Zagreb to a wonderful man Laza Lajdevic, one of the most educated and best businessmen in Croatia.

PAGE 73

Simo is at uncle Petar's in Tuzla. I heard that last summer he had again a strong Blutsurz\* but nobody tells us how he is now. When one does not hear anything, then it is assumed that he is well.

The youth organization "Zora" in Vienna honor yearly some great Serbian on St. Sava's day. Lat year they honord Vuk(Karadzic), Danicic and Sarlija(Njegos's teacher), etc. This year they are honoring **you thanks to God. They borrowed your picture from me for the event.** I sent it to them, but they did not send it back yet that Marica categorically requested, that her bedroom cannot be without your picture.

The newspapers did not write about this extensive "Tesla evening", but, it will be in the papers any day now.

Please write to us, even if it is only two words, that we know, that you are well and when do you plan to go to Europe, because they all want to see you. Greetings from Yours,  
Your Nikodim..



# 49

TESLA'S CORRESPONDENCE WITH RELATIVES    TRANS. N. KOSANOVICH  
PAGE 74

Marica Kosanovic to N. Tesla  
Tesla's sister

Rijeka, Italy  
Feb. 25, 1896

Dear Brother:

I cannot resist to write and beg you to write at least two or three words. I am writing this from my bed and tearfully writing, and you don't want offend your sister that which is true. I have been ill some months, and in this my sickness sadness overtook me, that from Nikodim's letters you know even if I wasn't sick, I am so weak that I spend most of my time in bed. My weakness is that one of us doesn't offend you, whom we have to look up to as a saint and to respect. I beg you and appeal with sisterly love who is the holiest of all, that you write at least two or three words, to know that you are not ashamed of us without this I don't think that I can improve in my health. Thank you very much for your gift a hundred times, that it came in a large amount. I will not burden you with a long letter, maybe you do not have times to read but I urge you in the warmest way that you write at least a few words and let us know if you are coming to this May's exhibit in Hungary. All are well and the best in spirit with love,  
Your thankful Sister, Marica.

PAGE 75    # 50

Mika & Radivoj Glumicic  
Tesla's sister

Skare Island, Italy  
June 13, 1896

Our Dear Nikola!

We were really surprised that you sent money the second time; we thank you from our hearts for your generous gift for your merciful and kind heart of brotherly love and noble consideration you have for all of your kinfolk.

The money was most useful for most necessary matters, and there was a true need, because our little son Djuro is already one year in a hospital in Zagreb, which cost my much sadness and money, in which you have helped us.

Little Georgina is excellent in school and in addition to school she is our joy and happiness; it is worth all of the difficulties. We read in the Newspaper that your arm was injured and we are worried. Please write and let us know if you are well.

Accept our True greetings and remain thankful.  
Your Sister, Milka

PAGE 76

# 51

PAGE 77    # 52



#53

TESLA'S CORRESPONDENCE WITH RELATIVES TRANSLATOR N. KOSNAOVICH  
PAGE 78

P. Mandic to N. Tesla  
Tesla's uncle

Pomaz, Hungary  
Sept. 6, 1896

My Dear Nikola!

It is more that a year and no word from you.

When I go to Serbia your name is in all of the Newspapers and honor you. But I would rather a single word from you than all of these testimonial in the papers.

It is such a long time, that you left us in an uninformed way and fear for you and god \* knows how long it will be before we hear from you; I am again risking, that this letter may bring a response, without big hope that it will not be such a long period again to hear from you.

I shall not; because, I do not have the will nor the time that I tell you about all of our kinfolk and neither shall I tell you, that Marica is rather well now, Nikola (Nikodim) her husband, the Trbojeviches, Milka are all well. My brothers, all three are fine.

My Marija married Lazo Ljevic-brother-in law of Vladimir Matijevic in Zagreb, my son Milan was promoted to Dr. di Juris. Now, he has to go in the military to serve one month with the 5th Imperial Ulan Battalion.

I and Lina live in Pomaz near our brother in law, but we have our home for ourselves.

A month ago A. Mechwart Director of Ganz & Kompag came to me. He asked me if it is true that you will visit us this summer and he asked me that if you come, that he wants to greet you and has something important to discuss with you. Among other things, here is his calling card.

PAGE 79

Day before yesterday I went to Budapest to an Exhibit with Jovan Jovanovich-Zmaj, where much was discussed about you. Zmaj is going to send you his latest poetry.

Brother-in-law Luna greets you, and I and Lina hug and kiss you; hope that you fulfill your desire; write me a few words, at least your signature. I shall be very happy if you write something. With god\* my dear that god\* gives you Vidovdan\*

Your uncle Pajo

\*He never seems to capitalize the letter "g".



Pajo Mandic to N. Tesla  
Tesla's Uncle

Pomaz  
September 6, 1896

My Dear Nikola!

I did not hear from you in a year and some months.

Whenever I come across a Serbian newspaper and see your name, about your honors and celebrity status. I would rather hear a word from you than all of this.

It is a long time, that you put us in such fear and ~~xxxxxx~~ trepidation ~~xxxxxx~~ about you, and god knows, how long will it be before we hear from you, I, however, risk sending this letter hoping to hear from you, without great hopes, to hear from you after such a long time.

I shall not, because I do not have time near the desire, that ~~we~~ send you a word about all our relatives; to tell you that Marica's health is coming along; Nikola, her husband, Trbojevic and Milka are well. All three of my brothers are well also.

My daughter Marija married Lazo Ladjovic-Brother-in-Law of Vladimir Matijevic, in Zagreb; my son Milan was promoted to De Juris-now he must go into the Army to serve [...], his one month service with the 5th Ulan corps.

Lina and I live in Pomaz with the <sup>B</sup> brother-in-law, but, we have our own home.

<sup>A</sup> A. Mechwhart visited me about a month ago, Director of Ganz & Kompag and he asked me if it is true that you are coming here this summer on a visit, and he asked me, if you come, that he sends you greetings and that you visit him, because he has something important to discuss. Among other words we[...] I promised if you come that I will ask you. I am sending you his calling card.

Day before yesterday I met Jovan J. Zmaj <sup>(1)</sup> in Budapest and we talked much about you and that you will be utilize your invention soon He sends his greetings

Brother-in-Law Lupa sends greeting and Lina and I hug you and kiss you. I plead with you to fulfill your promise and write at least a word or two. I will be so happy as though you wrote a long letter. Good bye and may god give you Vidovdan.

Your Uncle, Pajo

(1) poet laureate of Serbia at the time-mostly children's poems. Tesla translated his poems



Radivoj to Tesla  
Tesla's Brother-in-Law

Skare, Nov. 25 1896

Dear Nikola!

To your noble 'nameday' my heartXXXXXXXXXXXXX AND SOUL  
SINGS that God wills you a long life!

Your sister Milka and Brother-in-Law Radivoj.

Good Nikola!

Milka is very ill for more than a month so bad that she cannot get out of bed, and I am occupied with my service, I have to take care of her and watch over her. We had the doctor here twice and thank God she has turned for the better. Jovo and Angelina were here for a short time but they had to go home. Little Gina is doing well in school and this pleases us. Forgive me for giving you such news but what can we do. Please accept my and Milka's greetings.

Your

# 55

Radivoj.

PAGE ~~XX~~ 80 81

Marica Kosanovic to N. Tesla  
Tesla's sister

Rijeka, Italy \*  
December 6, 1896

Dear Nikola!

Although I do not know where you are at what place in the world, and will this letter come on a certain day-I salute you on your nameday wherever you are-nothing else-the best of health!Accept my most warmest Greetings! for the gift, for the many times you have sent me, and again many thanks.

I know that the changes among the family are known to you, Because uncle Pajo is the precursor of such Uncle Petar will go now to Sarajevo I know that pleases you as it does us-let him show how valuable he is. Simo was here for 2 or 3 months in Abbazzia(Rijeka suburb-now Opatija) and now he went to Iusinj. In a year he has improved in his health-he is now fairly well. Milka was somewhat ill, and now is well. Angelina with hers is well, only Pero(oldest) must take a semester off, due to illness. Those in Plaski are well, only Jovo(Major) Nikin's brother was ill all summer, he is very ill. That girl that who in Buda pest when you were there and sent greetings died last summer. I with the children and Nikon am well. Now, we worry about this parish. WE are in hopes that you will visit us this summer-it would help with the choice of Nikodim for the Parish. You would settle this. I only wanted to write two or three words Love you in Spirit, thankful sister,

Marica



Ljubisa Kosanovic  
Tesla's nephew

Rijeka, Italy Fiume  
Dec. 7, 1896

Dear Uncle:

I congratulate you on your nameday! May God find you in complete health for many and many years and to the glory of all Serbdom, and for the benefit of all humankind.

I often read in Srbobran (Serbian newspaper), and our children's magazine "Golub" to know that you are well, for how much you do work.

I kiss your hand, Your nephew, Ljubisa.

PAGE 83

# 57

Nikoladin Kosanovic to Tesla  
Rijeka, Italy  
Tesla's Brother-in-Law married to Mabel  
Dec. 7, 1896

Dear Nikola!

I greet you with Marica and Ljubisa on your nameday that God grants you health i a long life, that you realize all of your ideas and with your eyes see, how the word benefits from them.

Uncle Petar was here th4 other day and wants to come here in Rijeka, leaving Vienna for a visit He had in mind to apply for the Sarajevo parish on St. Nikola , but he cannot, the observance will be a week later. All of Bosna-Hercegovina is pleased that he was chosen as Metropolitan of Sarajevobecause from him comes a brilliant mind, and respected person that much good is anticipated. This is the center like Serbian Karlovac PatriarchATE. For them it will be Centrum Sarajvo.

Like that of Sremski Karlovci in Vojvodina.

In our newspapers (Austrian) we read often of you, somewhat unclear and half baked, some newspapers say for Roentgen's rays, that they are your invention. We do not know the facts.

Marica is fairly healthy, and her for sons. About the other relatives, Marica will write to you. In a few days I or Marica will have to go to Lushin to see Dr. Simo M. That he at least in a word says, our health is fairly good. With Grettins from all,

Your Nikoladin.



Marica Kosanovic to N. Tesla  
Tesla's sister

Fiume(Rijeka), Italy  
XXXXXX<sup>12</sup>, 1896  
Dec. 8, 1896

Dear Nikola!

I congratulate you on your nameday wish wish you health! Can you write two paragraphs with your hands, This would be so wonderful for me as a deed.

Madame Cuju from lika sends her greetings through a letter by her son, andi most warmly thanked her and I am afraid that you might even had seen her son. Everone is well and there is nothing new. I was a little weak frm last autumn, but now I am in fairly good health. Milka and Angleina with their families are well. I am afraid to write more , becuase you do not have the time to read it. Lvoe you in spirit!

I am your thankful sister

Marica

# 59  
PAGE 85

Angelina Trbojevic to N. Tesla  
Tesla's sister

Petrovo Selo, Vojvodina  
Jan. 2, 1897

My dear Brother Nikola!

I have written to you a few times, but I never got an answer. I do not know why you don't at least write a post card to know if you are well. My read about you from time to time in the newspapers and that the world ~~wazhiz~~ knows about you and not even a word to us in a year. I geb of you brother Nikola write at least a post card of a short telegram that we know how you are now We all here are well only Pajo is a little weak. He always mentions that if he only can see you once again . We are so happy that you will come here this summer, that you cannot decide to take such a long voyage, nnd you know how you make mistakes, if you somehow cannot come, so we will see you. About myself thank God that I am always in good health and the children a also well and good and gifted. Pero is now in Debrecin, learns only the Hungarian language, because to hold a Tekelija stipend one has to know it well for the exams and that is why we sent him there for a year. Uros is in Gospic in the III Gimnazium (high school) Nikola is still here in the IV and Marica and Milica are home. Marica at Rijeka is completely healthy now Milka was ill, but is much better and is about. My dear brother write to any one os us three just to know about you and we shall share the knowledge. This summer you sent me money a few times, thanks you much that you though of me, As you know that every penny goes for the children's education. Take care of your health, you are the only brother we have. Papa greets you Greetings , sister Angelina



Trivun Mandic to N. Tesla  
Tesla's Uncle

Gracac, Lika  
Feb 8, 1897

My Dear Nephew:

Time had flown like a second since our separation, and in such a long time we ~~were not of any help to each other and cannot but~~ through letters ask about your health. Already only nature drives me that I must awake and as where is my lighthouse -our dearest relative

A long time ago it was learned that I could find out where my great one lives.

What luck, that the means that only I can find my Nephew to hug him and love him from my heart.

Day after day it looked like your arrival but in vain and unsuccessfully abandon our hopes.

The heart does not give us peace, to decide to write some paragraphs at least that in distant land thrust myself on my dear and deserving nephew Nikola and would respond to your imaginary uncle, who prays to God that the health of his dear nephew stand up.

I would like to know how was that wine from London and the agency wants to know if you want to claim those casks, then I shall go to MIjatovic, to inform you and no answer - finally I wrote to Dubrovnik to the Late Simo, to inform you of this shipment if he knew your address.

At brother Petar's installation I was a participant in Dolnjoj Tuzla, when he was elevated to Metropolitan of the Tuzla Diocese and will go to Sarajevo for the other dedication and celebration.

Much was saddened for Simo, he was his right hand, and he said, and that we will forge him soon.

I would write a more detailed letter, but I shall stop now, who knows if this letter will find you, long letters can be boring.

If God gives me mercy and luck, that you reply, page 87 that would be the highest now ~~would help me~~ the greatest favor then I would more often your replies and please write that I will receive your letter with pleasure., and especially to know if you are well. Much is written about you and mentioned but do not know.

Now accept our complete family's sincere greetings, and with love from uncle.

Trivun



Marica Kosanovic to N. Tesla  
Tesla's Sister

Piuma, Rijeka  
(Rijek) Italy  
May 23, 1897

Dear Nikola I do not know how to begin since you haven't written to anyone. If I don't write, my conscience will bother me and I do hope for a word from you, and if I write, I am afraid that I bore you and disturb you; this time we are more concerned because no word from you in a long time nor anything in the newspapers about you. Uncle Petar wrote a few days ago and asked if you write to us, and all of the kinfolk raise this question up to me, and I sadly cry to a letter from Nikola. I have no hope in hearing from you now and I beg of you to write a few words, two or three, to settle my nerves -that at least you have written to me. I shall send it around as a circular letter, and help put everyone at ease.

I beg to God of you, do not be offended, that I requested a reply to a young man who[....] His is the son of a prosperous businessman in Chicago for three years. He writes often to his father who knows about you; we are most fortunate to hear about you from him.. His father and mother are very honorable people-everybody respects them. His father began with nothing and now has three homes here. His mother was here today and showed her son's letter and asked for a recommendation from you-I had with trepidation had recommended him to you. I have the fullest confidence in his parents. Please, don't take offence! I shall pray to God for your health and in spirit  
Your thankful sister, Marica. ALL ARE WELL.

PAGE 89

# 62

Marica Kosanovic to N. Tesla  
Tesla's Sister

Rijeka, Italy  
May 25, 1897

Dear Nikola!

These days I have written because of this gentleman and his father comes here that I do him a favor and write to you that he is to visit you. He completed the 5th grade High School and showed an inclination for mechanics. His father said that what he had done at home, without any knowledge of science. He had a big desire for some years now to come to your laboratory, but did not want to ask until he learned the English language well enough, reading and writing. There in Chicago he is in Chicago and is 21 years of age. As I have written to you, his family is respected and beautiful. His father is very capable as a merchant. There was no need for him to come to America, but felt that he can go further than being at home. I for my sake, ask of you not to be angry with me and can you take him in, and he can be useful to you. One, he is talented and respectful. They say he does not smoke and does not drink, and is always occupied with some useful matter. Thirdly, he is strong and healthy, from what ever reason he is chosen, you would find him useful. However forgive me, it would please me very much, we then would hear about you more often. I recommend him highly and beg you to take him in, and I hope that it will help your soul.

Thankful Sister, Marica.



Milka Glumicic to N. Tesla  
Tesla's sister

Skare  
June 6, 1897

Dear Nikola!

As Radivoj had written to you, little Gina is completing the (Licee) high school and I do not know what to do for her after that.. I would prefer to prepare for a Teachers College, but I await your advice. I would rather hear what you might advise. A word from you and my biggest concern is your health that you can tell me. That is why I beg of you to write. We are well, accept my greetings  
Your Sister Milka

Danilo Skrbic to N. Tesla  
Tesla's Cousin

no date!

Dear Cousin Nikola!

I have an inclination that as a relative you forgive me, if you in the strange or foreign world with my request about my son, who works there in America as a traveling salesman - I am compelled to bother or annoy you as his uncle to do something for him, that he be with you until he gets another job, because, here there is nothing for him and he worked in business for a long time. he lost his employment due to lack of business.

However although we are distant relatives, your your late mother's father and my late father were brother and sister. Meanwhile I served in finance and visited your late aunt, and you may fairly remember me.. I served for 40 years in Rijeka as (zollovberofficial) and now I occupy myself with the presidency of the Serbian Church in Rijeka and I recommended Rev. Niko Kosanovic as the parish priest. Marica is fairly well now like she and I send you warm greetings and recommend that my son work with you so that he does not run into disaster elsewhere.  
Your Loving Cousin Dane Skrbic



Marica Kosanovic to N. Tesla  
Tesla's Sister

Gomirje, Croatia  
Aug. 11, 1897

Dear Nikola!

Your precious gift was so useful and good like a long for holy water and I am speechless to find words how to thank you. May God give you good health and let him fulfill every desire and keep you from harm-you have been so helpful to us with your concern for us. May God grant you good health, because you are so useful to us. Your concern for us your protecting us so much as a result we can endure our problems easier. ( I am not thinking of material ones). I could not thank you immediately, because, I was full of worry and unhappiness recently and now thank God it is better -I am telling you and thank you for all of your deeds. I couldn't tell you before because I was full worry and unhappiness until now. and now thanks to God it is much better. We sent the doctor yesterday and now our bills are paid. We are this month in Gomirje because Niko was ill (spit blood) and the doctors sent him here (....) and we selected Gomirje. I was afraid because he is very weak and now he is much better and the honest truth he recovered here completely-he decided to quit smoking and that was his biggest downfall. Here he looks like never before. We were yesterday at Savo Mirvos's if you remember, and asked me to say hello to you. He is very poor but now it is much better for him now. That lady Mrs. Cirlic from Fijun visited me the other day and thank you for your favor and took her son into your laboratory. Thank also from my side and now luck has improved-that you accepted him at my request-SecondlySecondly, he can keep us informed about you due to his frequent writing to his parents.. All is well, and all send their greetings Most thank to you and I love you

Your Thankful Sister

Marica

Milos Mandic to N. Tesla  
Tesla's Cousin

Belgrade, Serbia  
Sept. 16, 1897

Exalted Sir Nikola Tesla, N.Y.

My dear Cousin!

Something has for a long time drags me to you new homeland. It is because due to my military obligation, I could not think about going on a long trip.

Now since I have completed my military obligation and receive a travel passport, now I would like to make this voyage. I apologize if I caused you some inconvenience and ask you opinion what you think of my going there.

I am the son of Dane Mandic from Tomigaj and left him since 1885 as a businessman, served in the Army for 1894-1897 as a Sergeant(...) I completed the 5th grade and 3 years of business school in Belgrade- and would like to have a private business no matter what type.

It is good to know that I spent time in Fijune at sister Marica's and Mr. Niko Kosanovic's while I was in Fiume for 2 years as a soldier.

PAGE 94

During that time I list was often at Uncle Pajo's the Colonel and you can write him, thirdly I spent a year in Karloac where aunt Sekulic, and she said that had invited her son and that he is going which we often discussed. Now I have a desire to come at the first possible time and I ask you brother? It is possible you can also find me a job.

I read and write only German along with our native language and also in every conversation I mix the grammar and vocabulary of these words like every Mandic of which you know our branch. While I did not have the fortune for you to know me personally, I am sending a photo, and hoping that you do not forget me. That you have many Europeans there, and among all I would not be lost. I am counting on you good will and you great popularity that you enjoy, and this will help me get employment and achieve success.

Because it is not for me to write everything in a single letter. I can tell you more when I arrive. I in this hope await your approval and am prepared to travel. I beg of you to show me the travel route.

Brotherly Greetings

from my hear and immediate replyt.

Milos D. Madic



Nikoladin Kosanovic to N. Tesla  
Tesla's Brother-in-Law

Rijeka, Italy  
Oct. 12, 1897

Dear Nikola!

Marica had recently written to you and thanked you for your gift. I also thank you. She was on the mend all summer at the forest with the clear air. But again she has lost her strength and mostly because she will not get a good house maid. She wants to get a servant of her choice.

Our four young sons are well; three are in school and the eldest Ljubisa is in the II year of high school in Susak. Children are good students but do not read their school books.

Uncle Petar from Sarajevo was here last autumn for 2 or 3 weeks here in the litoral (seashore) to rest from his duties and problems. The Sarajevan public criticised him in the newspapers, that he is radical; now it is less critical toward him saying that they have their hands full with this man.

Uncle Toma was here recently. He went to Zagreb to consult a doctor, might be some kind of pathogen (bropa) (....) it is a cataract that has to ripen in 5 or 6 months.

We were in Petrovo Selo for about 2-3 days last autumn. Angelina & Jovo are well. The children are well. Nikola is now in high school I grade. He is a very unusual chess player for his age. He beats all of us provincials, but not, his chess masters.

The sister of Simo Majstorovic is marrying a Trbojevic in Gracac, son of a priest Theodore salutes the young one and civil servant in Bosnia. Marija's uncle Pajo from Pomaza marrying Brother-in-Law Matijevic in Zagreb to a businessman Lazo Ladjevic. Her brother Dr. Milan Mandic was a delegate for the Serbian Orthodox Church in Karlovac. He was elected unanimously in Gracac. Thank God that they did not choose me for any function, because, I did not know what to do at the Sabor

PAGE 96

Gina, Milka's daughter, completed the High School satisfactorily in Gospić, now she is in the pedagogical school in Zagreb.

I am now Post Discrimina chosen as Pastor. There will be more when I tell you; I finally gave up smoking. Marica says that now I am a completely different man since I stopped being a gypsy. A newspaper from Osijek [....] wrote a translated article from a Boston paper N. Tesla (.....) another hymn dedicated to you. They praise your work vis-a-vis a telegrapher, some Italian Marconi. I believe you know this.

We now cannot ask you for you to tell us about yourself--100 greetings & kisses from Marica & us.

Your

Nikoladin Rev. Nikoladin Kosanovic

Rijeka Oct. 12, 1897



Milka Glumcic to N. Tesla  
Tesla's Sister

Skare,  
Nov. 9, 1897

Dear Nikola!

I recognize your great generosity, that you have done for us especially now, not only to me but, to my child Djuka.

She now is in Zagreb in a State Teachers' School and is preparing to work in September of this year

We pay 25 Forints monthly for the apartment and the materials are a few Forints monthly. Your letter of 1893 is still intact.

I wish you the very best. I remain your Sister

Milka

Skare Nov. 9, 1897

Simo Kosanovic To N. Kosanovic  
Tesla's Cousin

Grubosnjo Polje, Croatia  
Nov. 11, 1897

Respectful Cousin!

You will be completely surprised for where after all of these years, and from this region I am writing to you-but before I explain, I must tell you how-we are Cousins-I don't know if you care to think about your youth in our karst Lika and we are your relatives if you may remember, then it is known to you that my father Simo Tesla from Raduc and your father Milutin (Very Rev.) in Gospic are children of two brothers. I knew about you, that with your mind you have achieved so much, but I did not know until now where you lived? I wrote to Washington and the letter was returned and now I am writing to you in New York, because I yearned you were there and whether you forgot our common homeland and those who left for all parts of the world.

When you were in Gospic, I intended to go to see you and converse with you, but, sadly I could not go; we were too poor to travel and buy a ticket.

I settled here, married & raised a family, which except for the two of us, one more now and that is a boy who now works as a printer. This is in short my life and with with a village school teacher's pay you know what our material status is. Impoverished at home and the house is the same.

I hope that my letter finds you in good health, and you will write and the three of us greet you warmly. BROTHERLY GREETINGS.

PAGE 99

When your address is: Simo Kosanovic, School Teacher in Grubosnjo Plje, Croatia. Don't be surprised that my name is Kosanovic instead of Tesla; it is the reason that uncle inherited the Kosanovic estate who was called this and we kept it. One thing is if you can send a photo of yourself

Brother Simo



Danilo Skrbic to N. Tesla  
Tesla's Cousin

Rijeka, Italy  
December 4, 1897

Dear Brother Niko, Hello!

I don't know if my late aunt and your mother mentioned me to you that I in my early youth left Lika, and now I am now in Rijeka as a [AOLLEAMTER] & served 40 years and also a [ZOLLOBAROFFICIAL]. Now I have a pension. I often mention my kinship-your late mother's father & my father's mother were brother & sister. I am compelled to ask you in a far away land, if you pay attention to them. Do me a favor

My only son who lived in Rijeka(Fiume) many years as a businessman has a desire to travel to American to find work; he is prepared for a job only if he can be guaranteed his existence, besides he is bright, who learns fast, and I beg of you, that in this far away land, if he came to you would you help him? If not in your laboratory, at least some kind of work, if you can recommend him to some stranger to find bread.

In the hope that you can do the above and your sister Marica sends greetings and Very Rev. Nikola, who are in good health and I wish you.

I Remain Warmly

Your faithful brother,  
Danilo Skrbic- Zollobarofficial President Serbian Church

PAGE 101

My son will cross the ocean and will remain with Josip Cuculic and as that you recommend him and take into account that you will help him

PAGE 101 2

# 71

Nikoladin Kosanovic to N. Tesla  
Tesla's Brother-in-Law

Rijeka, Italy  
Dec 9, 1897

Dear Nikola!

First of all I wish you good health on you nameday. On this day in this region many glasses will have emptied to your health.

We wish a word from you. Marica is more fearful that you might be angry, when you did not write since we are in Rijeka. If you were a small man, we hear about you in the newspapers and we think everything. We recently read that a firm was organized with 500 million Forints of capital, who will build a railroad from your system. You can imagine how much this pleased us.

In mid October 9, I wrote in more detail about the family. Everything is the same. All are well and in peace. Milka had a step son who was ill with (Skrofuloza). That boy had died & freed her and the father of worry and trepidation. We are well here. My brother-in-law S. Kosanovic was appointed in Plaski as a Very Reverend.

You accepted at the suggestion of Marica a Cuculic as a lab assistant. His parents are good people and influential. We see each other often. Now, when you don't have time to write, the boy can tell me when he writes to his parents at least to know about your health. This will make us happy.

A million Greetings

Your Nikoladin



Marica Kosanovic to N. Tesla  
Tesla's sister

PAGE 103 # 72

Rijeka(Fiume) Italy  
June 4, 1898

Dear Brother!

I do not know how to thank you for your generous gift; should I thank you or should I apologize for accepting so much with a telegram. In my desperation and difficult situation I did not know where to turn. Nikola had to go to Gleihenberg(for TB) and I panicked. When I had seen that there was no other recourse-I relieved him of this concern, because he did not know where to borrow money.

Forgive me I beg of you dear brother, and I know that you will because you know us well-tht I am very sensitive about the matter and it was my special problem, when I had to tell you by telegram. May God grant you health, to help remove such a burden from me. Niko went in[....] and if God may save him, because the doctors say"[.....]" I suffered for a year and he coughs consistently, and a specialist says after 3 weeks here he will improve. I do not want to complain how it was in the recent past, along with such concern that I do not become ill. May God grant you health and I do not know how to express myself what is in my heart.

Grateful Sister  
Marica

Monsieur Tesla, electrical engineer, New York

PAGE 104 # 73

Marica Kosanovic to N. Tesla  
Tesla's Sister

Rijeka, Italy  
Oct. 19, 1898

Dear Brother!

I had hoped in hope that as a result of good news about Niko's illness would you would send at least one word; but nothing. I do not think of anything else that possibly someone here had offended you that you don't write. I also thought that you had forgotten the Serbian language and it gave you problems-or you have a lot of correspondence, because there are many of us.[...] You can reduce your correspondence and send me a few words-ti ne wgi us unhappy, because Niko is two months in Gleihenberg and I would circulate your letters to all of the relatives. It doesn't pay to ask you even if I beg you, it would be to no avail. You must have so much work that you do not write. and I am not the only one who is bored-there are many of us of all I am one of the most delicate and sensitive ones, because I cannot mention your name without tears coming to my eyes. Therefore I again plead and beg of you that you fulfill my warmth and write at least a few words, and I pray to God that will be my only conversation. Niko writes that he is better, but, he remain hoarse and will not be there for a longer period; only, if God lets him live even with that hoarse throat. Todo(Theodore) Trbojevic passed away and the others are well. Uncle Petar is with Niko in Gleihenberg. He is not afraid.

Your Thankful Sister, Marica

PAGE 105 # 74

Djuka Glumicic  
Tesla's neice

Karlovac, Croatia  
Nov. 8, 1898

Dear Uncle!

I declare that my letter to you will be boring, and it comes as a burden to ask you something of a favor.

You know now that I am in Teacher College in Karlovac, and am in the II year. My step-

father is ill and has to take off from work, whereby, there is never enough money to help me in school. I begged the Director of the school to get me assistance and he said that he will try very hard and he said that I ask you at least for books & tuition so that I can continue. Dear Uncle I am ashamed to have to ask you and nothing else is available. I am the worst dressed student and in my school and what hurts is that they say I have an uncle Nikola Tesla. Dear Uncle they look at me as an orphan who was left with nothing since my grand mother(Djuka Mandic-Tesla) died. Please remember her last words that she told you. Please send me if only some coins and I shall be thankful for this small gift that is very little for you.

In the hope that you fulfill my wish, I remain  
your Neice, Djuka Gina Glumicic.



Angelina & Jovo Trbojevic  
Tesla's Sister & Brother-in-Law

PAGE 106 # 75

Petrovo Selo, Austria Hungary  
Oct., 9, 1898

My Dear Brother Nikola!

I don't remember since I have written to you last and you Nikola had not written for a long time either. We all feel badly that you did not write. We are fearful that all is not well with you. If things are as they should be, you would have written. A person when he feels well writes to strangers let alone to his sisters. We do not know absolutely anything about you. When one asks we shamefully tell the truth which exists. (0) one thing about you is when the newspapers write about you which is positive and good but we don't know. I can say for Jovo and his father and myself all is well. I have five chil-

dren-educating three sons. Peter is in Budapest, third year law student; Uros is in high school in Karlovac; Nikola is in Budapest II higher school and Marica is in the second year elementary school and Milka is only 4½.

All my children are well and gifted (especially Nikola who is in II Engineering school in Budapest perhaps because he is your namesake. You must definitely know that I have many worries and work hard, but, what can I do when it has to be. Both Marica and Milka are well. Niko (Very Rev.) has his health back since he was in Gleichenberg. Milka's husband whom you don't is very ill and doesn't care to live. She has nothing but that one girl who is in II Pedagogical School. Uncle Petar was here last summer. He looks very well and is happy and uncle Pajo (Paul) is well also who writes often. Both complain that you don't write to them. Uncle Petar says that he will write and hope you reply. I beg of you to write to me or at least a post card and just say that you are well which would make us happy. It is hard to accept this lack of writing, because nothing is known about you. Yours as Always. I dream about you.

PAGE 107

and run to the post office and nothing. Moreso, I pray to God that you find time /ne/2 to write. Jovo sends his greetings and I and the children, ANGELINA

Dear Nikola!

Where Angelina has written hurriedly, because we are very busy and overworked.

Truly we are all sad that you never write a word, even this among strangers is a big shame.

We know that you are very busy and you have little time, but however, during a month's time to suffer 1/4 of an hour. The truth is this-that a person forgets his closest relatives when they are not before one's eyes -they [....] but that should not be because blood is thicker than water and kinship ties are stronger than any other; especially when the same and none with their evils are accepted, just like your kin never hurt you. However, you sent us 2 or 3 times a considerable sum of money and even this year in May, 119 Forints, which for both of us and our children we thank you to heaven. This money we use intelligently & usefully for the education of our children which in fact cost us large sums. It is not fun to send 2 sons to Budapest, and one to Karlovac. Just think what all of this costs! Besides this our home expenses and the other children have to be taken care of.

That is why my dear Nikola-be good and write often; at least to us even if you didn't send anything; we will do without and tighten our belts to make our children happy and among our friends we are proud. Our children are not small & young anymore. Our Petar is already in the III year of Law school in Budapest which will not make you ashamed.

PAGE 108

Warmest Greetings, I Remain Thankfully Yours, Brother-in-Law Jovo Trbojevic

PAGE 109 # 76

Djuka Glumicic To Tesla  
Tesla's Neice

Kralovac  
Dec. 6, 1898

Dear Uncle!

Words cannot express to thank you for your generosity in helping me. Almighty God may he grant you health and that you are the darling of all Serbdom. With Special Thanks, accept Your Thankful Neice, Djuka Glumicic



Smiljana Obradovic to N. Tesla  
Tesla's Aunt

Gracac, Lika  
Dec. 27, 1898

Dear Nikola!

You will be surprised to read from where I am writing at this great distance, If I was compelled, I would not tell you now.---

It is known to you that our Milka, your sister was with me for 16 months as my burden along with my poor children. I accepted here at hyur and Petar's request or ;urging.

When we separated in Gospic, when our late sister died(Djuka), you promised to send me monthly funds; so that I take Milka with me. It is possible that you forgot, and this burden is not seen by anybody.

Dear Nikola! Believe me as your aunt, I am not complaining to bore you, but I must, because I am forced to.

Not only had I kept Milka with my expenses and even Milka's debts which I paid 70 Forints to Islirovic. I beg of you to send me the amount and for the cost of keeping her and her daughter. I shall be satisfied if you can send it soon.

If it wasn't for my great need, believe me I would not bother you, but I need it for my two children. I do hope you send it.

In the hope that I do not remain without success, I greet you warmly,  
Your Aunt, Smiljana Obradovic

Marica Kosanovic to N. Tesla  
Tesla's Sister

Rijeka, Italy  
Jan. 20, 1899

Dear Brother!

It is a long time since I have written; one, is that you never reply and with this I am afraid that my letters bore you. The other is that I have nothing good to ite and it is not for you to listen to my woes.

Please do not be angry with me so I pray to God that I turn to you and will try to write a short letter. I know that you were told about Niko's had tuberculosis and this is his second time [....] and even the doctors told me it was TB. I was surprised when I read in yesterday's and today's "Budapest Tagblaet" newspaper, everything that I showed you, if this is not a hyposthesis. I rely on you more than God to whom I kneel down every day and pray that none of my four sons are afflicted with this contagious disease for whom your suffering sister would not have any idea what to do. I beg of you as I pray to God and answer me if you can help Nikoladin, because here if he can go to the doctor in Vienna. He is still fresh and clear and is not as thin as before, but, he coughs consistently. If he can be helped please tell me because [...] to try to end the coughing and fever. I congratulate you on your latest invention. I do not know what it is; Ladjevic sent us the newspapers that you sent to Matijevic. You did not mention these matters, but to the Russian Czar; you would immediately know Russia would accept this. We believe you had done this already. Poor Milka is with Angelina; they are all well. I cannot extend my writing because I ask you to tell Cuculovich and he could help me with that I could relax with fewer worries.

I salute you and please write at least a word/ :pve upu in spirit Your Thoughtful  
Sister

NOTO BENE: One doctor[...] Djivovic a Dalmatian, who is in America for 3 years. I ask you to write to him if you would take him in your laboratory. He says that he is a Mechanical Engineer and knows quite a bit. I promised him that I would write to you, because he treated my children's and my teeth. O conclude with a word



Marica Kosanovic, to N. Tesla  
Tesla Sister

Rijeka, Italy  
March 20, 1889

Dear Brother!

My Lord don't be angry to your sad sister who is in bitter straits with the telegram and argue. I wrote about 2 months ago and complained why you did not write about the news in the newspapers, and when you didn't reply, maybe it is nothing. Nikoladin is suffering and waits daily for a letter with the hope that you might help him-and when he sees no mail from you in response to the telegram I sent yhou Forgive me my dear brotherbut I am very angry of how I fear for Nikoladin's life.

I kiss you hand for this gift that you sent. May God grnat you health and that is why I pray to him. Sava had to thank you in place of me, because, I was ill in bed for one month and recently was able to get out of bed. I am weak and forgive my for writing like this. Milka & Angleina and all of are well. May God grant you health. I Remain your Thankful Sister, Sad Marica

Marica KOSanovic to N. Tesla  
Tesla's Sister

Rijeka, Italy  
May 1, 1889

Dear Brother!

Please don't be alarmed by my letters- I am brave a l true daughter of Djuka's. I write this letter now becuae I glrieve more for you than myself.

But where is their intelligence that they telegraph you and God has seen them. You are a mild mannered person and I feel sad why you answer so infrequently. You don't answer sometimes with not even a word and so it is like that, you must think about us; I am, thank God, holding up; God has given my strength to appeal to you further. The children, all four, are not onnly talented, but also good and noble. This is my conversation of of enjoyment & hopeI indend to stay here; Sava received an administ position and I will remained with the children. Sava is noble and good and will help the child no matter what it costs. I shall have a small pension and the children will received scholarsh stipends. I am in fairly good health and much better than last year; however, I am in good str. Angelina was here for a period of time with me and straightened me out mentaally. Otherwise al well and as bad as before Angelina was here. The uncles write often as before; they are well, they have rheumatism. Vladimir Matijevic was here the other day and he tells me that I am sadt instead of that telegram, you did not write a letter to know what you are thinking. Forgive the letter, and you do not have time even to read them. Love from YOur Sister, Marica.

PAJO MANDIC TON. TESLA  
Tesla's Uncle

Pomaz, Croatia  
May 24, 1899

Dear Nikola!

It has been a long time since I received a letter. It must be at least 3 years

How many of my letters: Many were return requested and all remained to my sorrow unsuccessful. Possibly you did not get them or did you?

It is better that one who to receive than one whom he loves, whom he praises and I would be s in my life to to be ready for such a long time for a word and this desired word is not received.

What are your promises that you gave me in Varazdin that you would write me a letter every m Did I offend you that you did not send me any letterl?

I have lived like a victim and many sad events among my kin that I lived through and now these days that life has to offer me andthe deepest wounds before I expire.

refresh ny monotonous lifefrom your hapiness; a reason to live.

This is what my sun hides behind the oceanI must soothe my nerves from be put into a coma.

If I know how to write such words that wouldflow comfortably to you and you solve your holy bility; put your answer with terse questions that I would dearly like to see.



81

Pajo Mandić to Nikola Tesla  
Pomaz, May 24, 1899

Pomaz, May 24/12, 1899

My dear Nikola!

A lot of time has passed since I last received a letter from you. I think this was perhaps three years ago.

How many letters have I written to you? Registered and double registered, but unfortunately to no avail. Perhaps they never reached you or...I would rather not say anything else!

It is a bitter experience for someone who gives his love, his admiration, is willing even to give his life - to await news for such a long time and not be able to receive what he yearns for.

What has become of your promise - given to me in Varaždin - that you would write to me once a month? Am I guilty of any wrongdoing, anything to justify your keeping me so long without - news, consolation, joy.

My whole life has been one of suffering, many sad events have taken place in my family. In the numbered days of life left to me - bestowed upon me by fate - you will have inflicted even deeper wounds to my heart, which I will bear until the last of my days.

The hope I cherished in my heart, which upheld my dull life, has come down to You as the only one who could bring me bliss and joy of living. But even this one and only sun I have left is hiding somewhere far away, beyond the sea and the hills, so not even one feeble ray of light could reach me to wrest my languishing spirit from lethargy.



81

Pajo Mandić to Nikola Tesla  
Pomaz, May 24, 1899

Pomaz, May 24/12.1899

My dear Nikola!

A lot of time has passed since I last received a letter from you. I think this was perhaps three years ago.

How many letters have I written to you? Registered and double registered, but unfortunately to no avail. Perhaps they never reached you or...I would rather not say anything else!

It is a bitter experience for someone who gives his love, his admiration, is willing even to give his life - to await news for such a long time and not be able to receive what he yearns for.

What has become of your promise - given to me in Varaždin - that you would write to me once a month? Am I guilty of any wrongdoing, anything to justify your keeping me so long without - news, consolation, joy.

My whole life has been one of suffering, many sad events have taken place in my family. In the numbered days of life left to me - bestowed upon me by fate - you will have inflicted even deeper wounds to my heart, which I will bear until the last of my days.

The hope I cherished in my heart, which upheld my dull life, has come down to You as the only one who could bring me bliss and joy of living. But even this one and only sun I have left is hiding somewhere far away, beyond the sea and the hills, so not even one feeble ray of light could reach me to wrest my languishing spirit from lethargy.



If I were capable of writing words which could satisfy and touch you, make you carry out your pious duty and write me briefly about your present situation. I would gladly and profusely do so.

In addition to this, my impression that you have become cold [...] and think less and less about us, what hurts me even more is that I know nothing about the accomplishment of Your inventions. When You sent me a telegram last year, I replied by telegraph, I wrote you a detailed letter, but received no further news from you.

I remember everything you showed me, what I witnessed with my own eyes, the excellent inventions You had produced instantly, newspapers published similar news, that you had succeeded, but then I was stunned as if struck by lightning, when I heard others had adopted your excellent ideas and begun using them. Like telephoning and telegraphing without a rotor, via Röntgen [...], have already been tested here by others.

Are you aware of this? I know what I have written up to this point will bore You, so I will not continue any further, but get ready for the next page, to hear news which have brought sorrow to us all. I'm not sure how to prepare you for the sad news, that our beloved Marica, Your sister and my niece, has become a widow with four little boys, the oldest son being 14-15 years of age. Our late Nikolica suffered from a long illness in the chest until he finally passed away last April.

This fall I stayed 4-5 days with them in Rijeka, hoping he would make it.

Poor Marica decided to stay in Rijeka because of her children. Her small pension cannot cover even the most basic needs. I have



sent her as much as I could spare. Petar has done the same, and I will definitely try to get her third son into our local boarding school at half or no cost. I have already asked about this and I will promptly do whatever is possible and necessary. We are hoping to send her second son to a cadette school. The oldest son is especially gifted, he is a student in Rijeka highschool and since he is not very healthy Marica wishes him to stay with her in Rijeka.

It is very important you let us know if you could send aid to Marica on a regular basis and how much that would be, so we could somehow plan her further life.

This whole winter I suffered from Rheumatism in the right hand and holding a pen and writing gives me great pain.

My Lina is in good health. Marija and Lazo are too, my son Milan has become a lawyer. Right now he has to go for military maneuvers [...] to join the third division in Osijek, later he plans to open his law firm in Pest.

Anga and Joco Trbojević and their children are well. We have managed to get a place for their youngest son in the local boarding school free of charge.

Perica is at the university as a Tekelija student in law school, he was here three days ago and has now gone home for his vacation.

I have not had news from the poor widow Milka for a long time.

Have mercy, write to Your loving uncle  
Paja Mandić  
Please indicate Your address.



S2  
Marica Kosanovic to Nikola Tesla  
Rijeka\*, not dated

Dear Nikola,

I just cannot understand what has happened, how come that in my horrible misfortune you have not written me a single word! Apart from my sorrow, this is what most upsets me, I just don't know how to begin. here I am writing to you again, perhaps you will have pity for your poor sister, and write a letter to have a word me in my overwhelming grief. That is the only thing in this world that could console me because I find myself in a horrible condition. I am now alone with four children in a foreign world with no one close here with me. Were I healthy, it would not be as bad, but I am weak and have just been defeated. I know not where to go nor what to do, whether I should stay here, or move for the sake of my children to a smaller town where costs of living are lower. I would be so happy if we were to receive a single word from you, we would know then that you remember us; how is it that all the misfortune that has befallen me has not moved you to write me a single word of consolation. My beloved and only brother, I beg you, show extreme love for your sad and sorrow stricken sister by writing only: I am well. I send you my love.

Please do not reproach me for bothering you because it is something I must do. Loving you spiritually I remain



your grateful  
sister  
mournful Marica

\* The place is not indicated. It has been deduced from the content  
of the letter.



(# 81)

except for this fact that you began not to think cold bloodedly about us, more so, it doesn't hurt me to not know about any of your inventions. zLas tyear I wrote and replied by telegram in detail but no answer.

I remember all of that and it is before my eyes what invention you brought out in one stroke. The newspapers mention similar things. I am surprised that you have succeeded without complaints vis Roentgen, etc.

Is this known to you? I know thaat this letter will be boring to you, so I shall discontinue to speak; prepare yourself for the following-sad news our Marica, your sister, my cousin became a widow with four young sons-the eldest 15 and the yongest 4. The long illness(TB) deteriorated Niko's lungs which happened in April.

I was there last autumn for 4 or 5 days with them in rijeka and felt that death will overtake him. Poor Marica decided that because of the children, she will remain in Rijeka. Her small income cannot cover her expenses. I sent what I could to help her and will try with all my energy to help see that the eldest son goes to school. He is an exceptional student and lives in Rijeka. The second son should go to a Cadet school I think. Firstly, you are capable of offering Marica help so that she can prepare herself for the future.

I was ill all winter with rheumatism in my right hand and with much pain. My Lin, Marija and Lazo Ladjevic are well. My son Milan became a lawyer. Now, he must serrve in the Army in the IIIrd Division near Osijek.

page 117

After that he will open a office in Budapest. For the youngest son we will work out something for a full scholarship.

Petar is at the Unversiry as a stipendist of "Tekelija" (1) He will come home in 3 daysfor a vacation. I didn't hear from poor widow Milka for a long time.

Take it easy and write when you can.

Your Beloved Uncle, Pajo Mandic Please send me you address.(1) Tekelija was a banker in Novi Sad.

page 118 # 82

Marica Kosanovic to N. Tesla  
Tesla's Sister

Rijeka ,Italy  
no date

Dear Nikola!

I cannot in any way comprehend what it is that you do not write at least one wor. Besides my sorrows this disturbs me more. I do no kknow how to begin and stil I write hoping you will become mercyful to poor me with my unlimited griefwith a letter and discuss our matters. That is one thing in the world that would placate me; my situation is catastrophie. With four young ones and in a foreign land alon(Italy) without any relatives.

If I was well & somehow my attitdue was notso dejected I could cope. I do not know where to go and what to do; should I remain here or leave because of the children and live in a smaller town where the cost of living is lower. Can you with only a word write? I would be happy if you think of us; alon with my problems at least write saying you are well.

Please do not be angry because I bore you, but, I must love you in Spirit, Your thankful sister,  
Sorrowful Marica



Marica Kosanović to Nikola Tesla  
Rijeka, October 24, 1899

Rijeka, 24/10. 99.

Dear brother Nikola!

I have heard from an engineer that you were in fact going to participate in the Paris exhibition and that you will begin moving your things now in November. I was - as the saying goes - as happy as a freezing man welcoming the warm sun, so I am writing you, perhaps you might want to reply. I am here in Fiume, waiting for your advice, what to do, where to go from here. My uncles are advising me to go to Karlovac, but I will delay my decision until the exhibition, perhaps God willing you will come, and then I would finally decide where to go. I must live in a town so my children could get their education. One of my young sons is in Pest. He has received [...] in a Croatian boarding school and is a student of highschool no. 1. The only good thing about this is that he will be able to learn the Hungarian language.

Sava is the administrator of this parish and comes here each Sunday to officiate. He could get this parish, but he has not decided whether to request it because he does not know whether we will stay here or not. He has told me and asked that I write You that he would go to Paris if it is true that you will move there this year. He would go to Paris to meet with you. If God were only willing to let you come, so I could see you, or hear news of you. I have also asked the parents of Cuculić (the one who worked in



your laboratory), but they have not been able to find out anything about You either. All our family is well. Please forgive me for bothering You.

Loving you spiritually  
grateful  
Marica



84  
Miloš Mandić to Nikola Tesla  
Gospic, December 7, 1899

Gospic 7. 12. 1899

My dear cousin!

It has been seven years since I last saw you and you have never written to me. A few days ago I received a letter from my uncle, Metropolitan Petar, in which he advises me to write you.

I am now a seventh grade student in the Gospic highschool, my older brother Petar has completed two years at the university (law school) and is now doing army service. I am good in studying. As you know, seventh grade is very difficult, one of the most difficult in highschool. So I am writing to you, my cousin, to let you know how it is over here in our parts. I dare ask you to send me, if you could, [send]\* money to buy winter clothes and shoes, and if possible before the 22 of this month, because it is already pretty cold. The amount of 16-17 forints would be enough, but if that's too much, then 6-7 forints would suffice for the shoes: I ask you as a cousin, a man the whole world and especially the whole of Serbdom appreciates, and we Your cousins can be proud to have such an exceptional man among us. That is why I have dared ask you for this small amount, knowing your generosity, so once again I [dare to ask you]\*\* [ask you]\*\*\* to send this to me, and may God give you health and joy and happiness, and help you accomplish your work, which your family and all Serbs will take much pride in. Mother and father send You their love, and I embrace and kiss You



Your cousin  
Miloš son of Trivun Mandić  
7th grade highschool student

Dear cousin, do me this favor, I will be grateful as long as  
I live.

Good-bye from your cousin  
Miloš T. Mandić

[I think you will remember me.]\*\*\*\*

\*     Inserted.  
\*\*    Crossed out.  
\*\*\*   Inserted.  
\*\*\*\*  Added vertically, on the left margin.



Msaricva Kosanovic to N. Tesla  
Tesla's sister

Rijeka, Italy  
Oct. 24, 1899

My Dear Nikola!

I heard from an engineer that you will in fact participate at the Paris Exhibition and that you will begin now in November and then visit your homeland. I was so very pleased like the frozen sun and with this I write that possibly you may at least reply. I am still in Fiume (Rijeka) and waiting for your advice; what to do and where to go from here.

The Uncles advise me to go to Karlovac and will not go until after the Exhibition; maybe God will see that you will come and then I could definitely decide where to go. I have to stay in the city due to the education of the children. One of my sons is in Budapest. He received [...] a Croatian stipend and is in the Gimnazium. One thing is useful that he will learn Hungarian.

Sava is the administrator of this Parish and comes weekly to serve in church. He can be the Parish priest, but, he hasn't made up his mind, because we are not sure of staying here; He told me to write to you to tell you that will go to Paris - i.e. if it is true that you will come here this year. I visited the Cuculievic's (the one who works in your lab) parents and they don't know anything about you. All of us are well. Forgive me for boring you. All of  
I am in Spirit,  
Your Thankful Sister.

Milos Mandic to N. Tesla  
Tesla's Cousin

Gospic, Lika  
Dec. 7, 1899

Dear Cousin!

It is already seven years since I had written to you. You never answered to find out where I was. The same day I heard from uncle Petar, the Metropolitan, in which he told me to write to you.

I am now in the VII grad in high school in Gospic and my older brother completed 2 years at the University and now is in the army. Science is easy for me as you yourself know the VII is difficult; one of the most difficult years in high school. With this I report to you, like my brother, that you know how it is with us on this side of the ocean. I have decided to ask you if you can send me money for winter clothes and shoes by the 22nd of the month, because it is cold here now. The cost is about 16 or 17 Forints; if not clothes, the for shoes which are about 6 or 7 Forints. I thank you as a cousin that the whole world is proud and Serbdom is happy and we your relatives are proud that such an artist was born among us. That is why I am asking for such a small amount, knowing that humanitarians are asked by many for financial aid. Please continue the good work and for the pride of Serbdom and kinfolk.

Greetings from Father & Mother  
Your Cousin, Milos Trivunov Mandic  
Student VII Gimnazium (high school)

I think that you remember me!/.



Tesla's Correspondence with Relatives

page 122

Marica Kosanovic to N. Tesla  
Tesla's Sister

Rijeka, Italy  
April 24, 1900

Dear Brother!

I only write this to relax and with hope; then you might show mercy and possibly write at least a word. Now is the Exhibition and you yourself gave us strongly hope and with this to be able to see each other or at least through the newspapers hear about you. I beg you, forgive me that I am so aggressive toward your silence which I don't understand; but sisterly concern does not give me peace and I cry until the tears dry up, then I sit and write you a letter-but I naturally do not send it being fearful that you would be very offended. Here, I abandon the real world and whatever a God offers. All of us are well and there are changes. I have decided to write a letter or so and possibly find out to get something in Plaski (a village in Croatia). We intend to [...] Ljubisa to send [...]; the third (Milutin) is in Budapest as an internist [...] he already learned Hungarian and is a good student. Angelina's Petar completed Law School and Milka's Gina is again doing well in school and is a very nice girl. You would please to talk with her. Young Nikola, our brightest is in the III year of High School in Budapest. Uncle Pajo is ill and uncle Petar is well and looks younger; Our Kosanovic's are well and concern themselves with my four. I am still in Rijeka and cannot move without your advice. The air is fine here, but, I am afraid of Plaski. Sava does not know if he should to to Fiume (Rijeka) or not and is still an administrator until he hears about you and your advice.

Love, Thankful Sister, Marica

Marica Kosanovic to N. Tesla  
Tesla's Sister

page 123

Rijeka, Italy  
Sept., 25, 1900

Dear Nikola!

Here I am writing again and I shall behave like this in the hope that you may answer one of the letters. One day I received a copy from a gentleman of The Illustrated London News which had your picture and an article which I am having translated to us. I kissed the picture & cried and then I worry that it seems you are so thin and possibly grey. I am so sad and only if you wrote a few words or by telegram and all of us would be at peace. I come to this thought that one of us offended you and as a result you keep quiet; On the other hand I maintain for you it would be a non-essential bagatelle to say it would be nice if Jovo Trbojevic was president of the US and I like most educated "ladies" to care to send 2 or 3 words by telegram; I would circulate this telegram. Here, the news is that Gina, Milka's daughter is getting married to a priest in Bosnia. That is uncle Petar's wish and we will think it would be better that she complete school this year and as a teacher contribute more. Meanwhile uncle knows what he is doing; because he brain is stronger than all of us combined. Secondly, Sava is maintained as a Parish priest in Rijeka and now I don't have to move from here. I am still here because Sava was the administrator. The other brother Stevo is coming to Plaski; that my older sister is not left alone. The oldest son Ljubisa was sent to a cadet school and will become an officer.



Tesla's Correspondences with Relatives page 124  
Little Milutin is in the II grade high school in Budapest. He has [ ] left. He is an excellent student like  
a. of the others. Uncle Pajo is ill. I don't know if he is better or worse.  
Thirst for Conversation, Thankful Sister, Marica

Marica Kosanovic to N. Tesla  
Tesla's Sister page 125

Rijeka, Italy  
Dec 6, 1900

Dear Nikola!

I greet you on your Nameday (St. Nicholas) with the first of my desires that God grant you health and  
that you write this year! I congratulate you but don't know where you are and nothing in the newspapers  
do I see. Be kind to your sorrowful sister and please write at least a word by telegraph to know if you are  
well and to know where you are! I will not write anything just to bore you less. Milka & Angelina and  
their children are well and the same with me and my children.  
Love you in Spirit, Thankful Sister, Marica  
Note: Rijeka was called Fiume at that time. It means river

Marica Kosanovic to N. Tesla  
Tesla's Sister page 126

Rijeka, Italy  
no date

It is useless to live in beautiful hope or you returning or at least some letter-but you do not want to write.  
Did anyone offend you? Please say so! Of all the kinfolk, you promised to write to me sheltered from  
spiritual bad mood. If I had offended you, I apologize and a large spiritual forgiveness that I offended  
you-what is Cuculic doing? It is possible that you become a non-believer-If it is so, I had suggested to him  
only from sisterly interest through him I can from time to time find out about you (Cuculic works in  
Tesla's lab). If this is a likely cause, I beg you to forgive me. I don't know if you want to show mercy)  
and possibly answer this letter.

I am going to Karlovac in February. My oldest son Ljubisa is there on military  
duty. The second son Dragisa is in the IIInd year high school and would like  
him to go to the university (Real). I am asking you whatever you can in the  
beginning and don't feel angry at poor Marica and help me get a postal job  
in the beginning. Jovo & Sava will help me with my grooms (sons). I ask if you  
can send something now. I ask of you dear brother, don't betray me. When I  
am heavily burdened, but, I have 4 children and that is not easy.  
Love You in Spirit, Marica.  
Ed note: From 1899 to 1900 Tesla was in Colorado Springs.

Marica Kosanovic to N. Tesla page 127

no date

Dear Brother: I don't know how to thank you for your generosity! Not that I was pleased  
with the money and that I am selfish -I am happy that after such a long time I heard  
from you. This is my first cheerful day after two years. I feel so well that you did  
not forget us. I was pleased above all that my sorrows and mostly that I might  
have offended you and wanted to asphyxiate myself. In my happiness and would like  
that you write more paragraphs to make me happy-more than anything in the world.  
I do not know why you sent me this and don't remember asking you. It is true that  
I am not in great need, because ~~Uncle~~ Sava ~~kind~~ ~~better~~ supports me. Milka is in  
Banja Luka with Gina and Angelina and family are O.K. I would like to go there in June  
Since, now I have money Uncle Pajo is much better; uncle Petar is well. I shall take the  
2 little sons to Lipik so they can bathe swim and bathe for a month.  
God grant you health and happiness and most success in your work. Your Grateful  
Sister, Marica



Marica Kosanovic to N. Tesla

TESLA'S CORRESPONDENCE WITH RELATIVES  
PAGE 128

Tesla's Sister  
Dear Brother!

Rijeka, Italy  
March 27, 1906

I salute you for your nameday, maybe you have forgotten which one it is, but, I did not I did not remember that I could have abandoned the greetings and did not forget this year! May God grant you good health and for other good things you can do yourself! I know you do not have time to read my letters; I shouldn't bore you and possibly not even read this letter, because you did not reply before.

All is well with us as before, but, my family is weaker. Sava is very weak and I am afraid that my children are all abandoned. My nerves are shattered and if one of your electrical machines may help me. God help me if I have to go to a sanatorium and then [...]. Milka & Angelina are well and so are the others among the kinfolk. Uncle Pajo(Pavle Mandic) is feeling better thank God and is able to walk around; uncle Petar is well, but, he has difficulty with these Bosnians(Petar is a church administrator in Sarajevo, Ed. note) Thank you for your generous gift of money! May God grant you health & satisfaction! I have a pension of 25 Forints and the oldest in Law Jovo (also on pension) sends me 25 Forints regularly-otherwise with Sava and Jovo's help help with the children, I don't know what I would do but both are weaker and I am afraid that I am weaker also and the children are small. Physically, I am well and strong enough and do all of the work at home-but I am nervous. LOVE YOU IN SPIRIT, THANKFUL MARICA

Marica Kosanovic to N. Tesla  
Tesla's Sister

PAGE 129

Rijeka, Italy  
Sept. 29, 1901

Dear Brother!

Whenever I prepare myself to write you something in me always: "Don't bore him and anyway he will not reply; when I have the urge then I don't write--only from time to time that is good for you not to be bored. If this is so, please forgive me because I cannot refrain from writing and beg you to reply. I have decided and as everybody tells me the home would be in bad straits [...]. Milka & Angelina write me and send their approval to sell the home, otherwise, I would become a beggar. Milka is now in Sarajevo and now she has nobody who can take care of her home. It cost more to live in the house than it takes in. Sign please, and we shall and the money from our deceased mother erect a stone for her. In the newspaper "Berliner Rudnschau", I read myself about you of a new invention, but, somehow bitingly as they normally write on this side of the ocean. Your picture was in it. It is indispensable & necessary that you send some American newspapers about your work. You have up to now promised and to our sorrow we do not have the material. Then, we would know that you are alive. Now, we know nothing about you. Please write, Marica.



Marica K. To N. Tesla  
Tesla's Sister

Rijeka, Italy  
Oct. 4, 1901

Dear Brother! (Ed. note-the exclamation was used then-now a comma is used for address.)

I wrote a letter recently and I am afraid that you will not be offended that I bore you; I am afraid of this more than that you won't and will not write at least a word or two to any of us.

I would like to know the reason; did one of us offend you that you had broken the correspondence with us. I write & write and include in every letter my sisterly love & concern and I always think that maybe the letter was lost when you don't reply. I write again in the hope that you may reply.

I beg of you, write! If the letter arrives and you read it, do not feel angry at your sister. I beg of you in the name of all of us, send us some newspaper that have something about you.

I became acquainted with a lady who knows English; she always asks me if I received anything as yet so that she can translate. I collect the old "Century" magazines and cry when she translates them to me. If you can send something up about you I would be happy.

I beg of you in the last letter your signature of approval to sell the home and also Gina Illic writes that we sell as or the might rze the home. Please send a reply and a newspaper article about you. Love You in Spirit, Marica

PAGE 131

Marica Kosanovic to N. Tesla  
Tesla's Sister

Rijeka, Italy  
Dec. 3, 1901

Dear Brother!

I was almost late to greet you on your nameday due to my illness from which I am feeling much better and my heart dictates this letter and that you may read it; I hope it is on time for (Dec. 19 (St. Nicholas Day) with the warmest desire in my heart. May God keep you alive and well for the benefit of mankind and your dear sister. May God grant you life my dear brother. WE would benefit not only to pray for ourselves but for all and also at least a word or telegram so that we know you are alive & well and to placate your sensitive sister; It is worthless to pray, because you are very busy to write, I Love you most, most noble Spirit



# Tesla Memorial Society Inc.

453 MARTIN ROAD, LACKAWANNA, NEW YORK 14218

## EXECUTIVE BOARD

William H. Terbo  
Honorary Chairman  
Nicholas Kosanovich (716) 822-0281  
Executive Secretary/Treasurer  
Patrick Porter, Editor  
Terry Howard, Media Co-Ordinator  
Philip Momchilovich  
Coord. Performing Arts  
Dr. Richard E. Dotlinger  
Paul Kosanovich, Archivist  
John W. Wagner  
Chairman/Youth Division  
Dr. L. Vujovic, M.D., NY-NJ Sec  
Dr. V.A. Tomovic  
Sec/Canada

## SCIENCE COMMITTEE

Dr. Slobodan Cuk  
Dr. James F. Corum  
Dr. R.C. Maglic  
Dr. A.S. Marinic  
M. Enagovic, Ph.D.  
Robert Hurvitz, M.D.  
Dr. W.J. Sarjeant  
G. Djukic, Ph.D.  
Dr. Goren Djukic

## BOARD OF DIRECTORS

Sidert T. Albert  
Lt. Col. Charles Bojanic, USAF (Ret.)  
Margaret Cheney  
Dr. Eugene A. Chermak  
Carol Costa  
Mary N. Cizio  
Brad Deder  
Mary Bogdanovich Dester  
Dr. Dimitrije Djordjevic  
Miran Drakulich, Sr.  
Mary Nicklanovich Hart  
Charles J. Herke  
Prof. Henry Jesonka  
Ben Johnston  
Dr. Douglas W. Jones  
William Jovanovich  
Karen A. Kiani  
Lewie Kolar  
Steven Korach  
Dr. George M. Kosanovich  
Dr. D. Kosovic, M.D.  
Michael Malyak  
Nicholas G. Mamula, Sr.  
Nenad V. Mandich  
Dr. Michael Markovich  
Dr. Nenad M. Marinovic  
Dr. Vasa Mihailovich  
Joseph Milosich  
Dr. Damir Mirkovic  
Lazo Momchilovich  
Donald M. Minos, M.D.  
Charlotte Muzar  
Dr. Valdimir Petric  
Marisa Pezzulich, M.D., P.C.  
Dr. John Popovich, M.D.  
Dr. Nikola Pribic  
Bobby Ratsyska, P.E.  
William G. Saltschik  
John Shattan  
Ted Shattan  
Dr. Zlatomir A. Simic  
E.E. Taylor, Ph.D.  
William H. Tesla  
Dr. George V. Tomashevich  
Dr. Nicholas D. Trbovich  
Pola Fotich Triandis, Ph.D.  
Desa Tomashevich-Wakeman  
Dr. Sherwood A. Wakeman  
Dr. Jasmina Weinghoff  
Dr. Stella Yakovich

## CORRESPONDENTS

W. Masche, Mn. Coord.  
Kevin Kosanovich  
Secretary/Youth Division  
Sarah Ryzek - Ch. NY Youth Div.  
Eike Moeller - Switzerland  
Dr. Djuro Kurepa - Belgrade  
Dusan Mirkovic - Belgrade

THE PURPOSE of this society is to honor and perpetuate the memory and ideals of the great scientist and inventor Nikola Tesla through appropriate academic conferences, scholarship awards, and various cultural activities.  
It is a non-political and non-profit organization.



Marica Kosanovic To N. Tesla

Tesla's Sister

Dear Nikola!

Rijeka, Italy

May 11, 1902

I beg of you please to write to any of us if you don't want to write to me. A single word from you would with your handwriting stop a million tears and strengthen me for future struggles. I now intend to go to Karlovac and find an apartment which I might have found already. I have no one here and everything is expensive. It will not be good there, because all my children are anemic and I am always in fear, however, it will be better because I shall be close to Angelina and other relatives & friends. Uncle Petar came here a few weeks ago and is well and looks strong. Angelina & Jovo are well and all the children are well & good. Even Milka, Thank God, is settled and is satisfied that her brother in law looks after her. Uncle Pajo is fairly well and now can read & write. My children are well, but weak. I am ill with my nerves and if would be possible if I could go to a sanatorium. Otherwise nothing but suffering. Please write and show your brotherly concern. Hoping for a word. Sister, Marica

PAGE 133

Marica Kosanovic to N. Tesla

Tesla's Sister

Rijeka, Italy

May 24, 1902

Dear Brother, Nikola!

Angelina & Milka write me that you sent your approval & signature in order to sell the homestead and now I write being fearful that you take offense. Now, it is not moaning, but necessary and I beg of you not to be angry at your poor sister who loves you! I know that your important and great thoughts & work keeps you occupied; I beg of you and pay attention to me who is left with four children. Please send us dear brother the power of attorney because that home is becoming dilapidated and all of us far from it. Why wait any longer. It will lose value in time. I am afraid that I offend you with this, but, believe me, I would not write at all if. I am very weak and spiritually worn out completely—that you write to us soon even the shortest telegram. I would be turned around with this and everyone would care for me better. Please, my only brother, decide to write with a few words and for my problems don't disturb you and forget them. I will count the days and hours for your reply to this letter and until then I shall momentarily be silent. I hope the you will.

GREETING & LOVE, THANKFUL SISTER, MARICA



Simo Mandic to N. Tesla  
Tesla's uncle

Gracac, Lika, Croatia  
May 15, 1903

Love You in My Heart,  
My Nephew Nikola  
Greetings-Long May You Live!

Her it is eleven years since you promised in Gracac that you would write often; not only do I read in the newspapers that you are alive & well; and Lord Almighty helped to keep you alive for the whole world's sake.

I come to ask you dear nephew that you write; did my son Demetrije come to see you? He was a tax clerk in Bosnia, County of Zepce and all at once went to America and without any illegal activities here and to you. I am sure that he left about 5 or 6 months ago. I looked for him all over Austria and no trace of him. However my beloved and hero nephew, I would feel better if you would take him under your wing. He was graduated from the gimnazijum and then went to Bosnia to my brother Petar in Sarajevo. I was with Demitije 3 days and got a job as a clerk immediately. I also had lunch with your sister Milka and little Gina married Rev. Lalic in Srajevo. He spoke about you as the greatest her in the world. Uncle Toma, the priest and uncle Trifun are well and all our people congratulate you.

However my dear Nephew, please reply to uncle Simo who is broken up about my son Demitrije; he hopes he is with you.

Thanks to Lord God that you reply and the warmest greetings. who loves & hugs you.

YOUR UNCLE SIMO.

PAGE 135

Petar Mandic to N. Tesla  
Tesla's uncle

Sarajevo, Austria  
Sept. 2, 1903

Dear Nikola !

According to your wish I attempted to work out a loan at the Serbian Bank and use your stocks as collateral, but, was unsuccessful.

This in itself is not surprising, because the Board has people who do not know of your firm [...] their officers do not approve for them to go into such an operation.

Our friend, Colonel Kosanovic disturbs us enough writing negatively about your situation there. This brought all of us concern. If it wasn't for this news, I believe that as a result of your personal court case that it is difficult for you to fight such lion-capitalists that you did not give up hope if God grants you health; to succeed. It is discomforting for every phenomenal discovery -all previous greats had difficulties with their ideas and then honored later. What would it be if they came easily without the consequences!

Matijevic was [...] and I had to write there and send him your stocks even though I knew in advance that matters will come to nought.

Dear Nikola! Don't be discouraged at all; you are thank God young; you don't have to bow to anyone and will not lose face. The strength & force of your Spirit is still on the beginning.. Don't give up. We are content in our work



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 136 CONT'D

I am preparing to travel throughout my diocese and must go far from my residence to consecrate a church; I shall pray to God for you also and for your health and everything will come about with God's help.

Accept my Dear Nikola warm Greetings in the whole Spirit  
Your Uncle Nikola Mandic, Metropolitan (Archbishop)

P.S. I sent the bank 5 shares of your stock.

PAGE 137

Rev. Toma Mandic to N. Tesla

Tesla's uncle

My Dear Nephew Nikola:

Tomingaj, Hungary

March 25, 1904

Enough time has passed that your old uncle did not remember how long and now it is in order to write to you! I want to ask you about your deeds & delicate health; because all the kinfolk and not only the, but all of Serbdom, is proud of you and your ingenuity; May God grant you health and success and a long life to be honored by all of mankind and especially people of the Karst region(Lika-limestone area) and your dispersed relatives! Bravo my dear nephew!

I know that every seconde is precious and that I don't waste any time and can only be repaid in gold, however to let you know I began this letter in the strong hope that you will, if it is possible, honor my request.

I and my brother-in-Law Dane Zoric formed a large factory complex in Brivno, i.e. a sawmill, steam operated and making bricks and finally above all when we had everything in place and began to function, we had a very low cash flow where we spent the last amount of money and all our assets are used up. We had to turn to a stranger with difficulty built the large enterprise and now when it is ready to produce, we don't have the funds; in fact we put our families at the edge of disaster.

My dear nephew we make bricks in small production and abandoned steam power for the sawmill and little by little it will get bigger and what should we do but remove the machines.

PAGE 138

For all of the possible factory demands I had to borrow a large amount of money(15,000Forints) (30,000Kr.) and pay high interest to Steklis in Gospic. It is necessary for us however to solve the very high interest rate and we are not in a position so we ask a loan from you of 20,000 Forints and will repay you in a short time and the other 5,000 F. to use for large scale production.

True, it is a large amount, but, you will not lose your money because you can in the first order & first place all our savings books recorded which is about 150,000 F(300,000kr) because in Likait is worth much more which you had seen as a child to evaluate.

The earth is good for bricks as examined in Graz; it is more in surface area. We have a whole mountain that extends about 20Km in area and the mills could be useful for 7-8 counties and it is milled. We await your reply. We shall endeavor to send you latest data and geography of the land and steam machine's schematic and whatever else you want.



very thankful and I remain eternally grateful for the generosity and expression of my thanks- In Gracac, Lika, Diocese Lika Krbava, TRIVUN MANDIC, WITNESS

PAGE 144

Dear Nephew Nikola:

It is all of 5 months that I am looking for you without success and turned to the editorship of Serb Patriots, to tell him where you live so I can send you a letter. Not a word or trace from you and don't know if you received the Maraschino wine from Zadar and I wait for a work from you and greet you You Sad Unvle, Trivun.

PAGE 145 written in Latin script

Stevo Budisavljevic  
cousin

Zadar, Italy(now Yugoslavia)  
April 1, 1908

Dear Cousin:

I see by the newspapers that the architect society of Vienna elected you as a corresponding member. In this act they honor and recognize your work as the highest in the electro-technical field. From the bottom of my heart and with the kinfolk in Zadar, I congratulate you and do hope that you continue your successful work and continue the creativity of your mind.

Who in the world does not know Nikola Tesla? It gives me so much pride that I your relative wrote this letter.

I am the son of the late Mane Budisavljevic, palace advisor and brother of great Governor Buda in Zagreb. I am married and am 41 years old; I have two children, Maria and Nevenka. I graduated from Law School and am the secretary of the Postal & Telegraph office in Zadar. My only brother Vladimir is an advisor of our government in Kotor (married with 2 children). My mother is a widow and lives here with 2 unmarried daughters. My late father's sister also lives here (Kata, 73) with 3 unmarried daughters. Whenever I find something about you in our newspapers, I read it to all the relatives and we are all proud. Why not?

I would like and our kinfolk for you to send some notes in whatever language about your life & inventions with which you are occupied now. I would be eternally grateful and I would insert it in our newspapers so our people would be proud of their son.

Please do not take offense, my dear kin, I am prepared with my weak situation to pay you back, now or whenever you want me to, if you could send a photograph of yourself.

Are you married? Do you have children? Excuse me for taking the liberty to ask you. I am in hope of hearing from you. Greetings from all of us.

Your Relative

Stevo Budisavljevic

Economic Sec., Postal & Telegraph Office, Zadar



Tesla's Correspondence with Relatives PAGE 146 147  
Trivun Mandic to N. Tesla  
Tesla's Uncle

Gracac, Lika, Croatia  
April 4, 1908

My Beloved Nephew Nephew Nikola!

I have already written four letters and not one of them was answered. The last letter I sent with Jovo Tomanovic, a banker and steamship agent at 561 Eleventh Avenue in New York and I asked him as a friend if he knows your address and the letter I sent was about the surprising and sad death of my brother Petar (Archbishop Nikolaj) of Sarajevo and Dabro Bosna who passed away in Abbazzia (Opatija) on the beach of a heart attack.

The judge needs your power of attorney to settle the estate which will take place in Gracac - we all paid 8 kronen 80 filers in the national news in Zagreb and no word or trace of you.

Jovo Tomanovic replied to my last letter the 29th of February and said the following as a reply to your letter respectfully.

JOVO TOMANOVIC

If this is true what Jovo Tomanovic writes, then I cannot know what is the cause that you did not want to write at this tragic moment.

PAGE 147

Please don't abandon brotherly love that I have to go to Tomanovic again and give him this letter if you did not sign a power of attorney or a letter to authorize settlement so that the unlucky inheritors can be satisfied and discuss the sad event that bothers me the most.

Now I conclude and ask you dear nephew for a reply before we have to wait another year. I hope that this sad letter gets into your hands and it finds you in good health and I would be happy to know where you live and other matters.

In Anticipation and most Gracious Greet you. Love Always, Uncle Trivun (Trifun)



DTrivun(Trifun) Mandic to N. Tesla  
Tesla's Uncle

Gracac, Lika, Croatia

Nenad Mandic of HBNM Chem-Great grandfather

Dec 7, 1908

My Dearest Nephew Nikokla!

On August 2 of this year-it will be a year since our unforgotten brother Metropolitan Nikolaj(Petar) died of a stroke in Opatija(Abbazia,Italy) I immediately wrote to many cities in America to find out your address so that you could send us your power of attorney or a letter of approval to settle the estate of my late brother finally. I haven't succeeded and finally went to an Editor of a Serbian newspaper in New York, Jovo Tomanovic and pleaded with him if he knows your address and that he mails my address to you. He replied with his letter on Feb. 29, 1908 the following.

"Mr. Trivun Mandic, Gracac, Lika"

Respectful Sir!

As a reply to your letter I personally gave Nikkola Tesla[...] which will surely fulfill your wish, He replied to me and this is what he said.

Respectful Jovo Tomanovic:

How was I able to find out from no where your address; then this settlement through the court was a year old which was given to m in January; the date expired and even if you received this letter -you have to send me a power of attorney form if you oppose the will to go to the person it was intended. I cannot believe Tomanovic's letter that you received my letter and found out the sad news of our Beloved Brother's and my uncle and a benefactor to the people of Sarajevo and not allow those manipulators to change the last will and testament.

Page 149

I shall write of the burial of the deceased and if I get a reply to this letter, the, I shall write in detail only if you judge our unlucky kinfolk positively.

The late one knew as I did that the inheritors are impoverished; he had life insurance with the Greschnam Society for 10,000 Kronen at[...]4,000 Kronen; the Savings Library-5,000 Kr., The expenses were 12,000. Now a nice tombstone can be purchased. The funeral was divine; there is no Orthodox cemetery in Rijeka to bury him there. We took the body to Sarajevo and buried Metroplitan Nikolaj there.

Being that the deceased expressed to live and did not want to die in Sarajevo, because, he was seriously offended there and finally when he completed the statutes for priests & pensions, then they finally those same torturers praised him to the sky.

I am for this that the body be buried at his birthplace and the inheritors agree and all the people will mention him until eternity. If my letter is accepted and if God wills it and if you reply to me and if you mention you love toward the deceased that the body be transferred to Gracac and anticipate erecting a stone and expenses for transportation can be assumed by the descendants if the estate funds are not sufficient. It would be a small sum for each. If I get a reply, I shall write in more detail about everything and this will be our conversation since we cannot do it personally. I wish that this letter which I write under pressure reaches you and wish you good health and I greet You. Love from Uncle Trivun



Tesla's Correspondence with Relatives Page 149 cont'd  
TRIVUN

page 150

"Mr. Trivun Mandic, Hotelier(owner) in Gracac  
Respectful Sir! As a reply to your letter I want to tell you how I gave the assigned letter. It was  
given personally to Mr. Tesla [...] which will fulfill your wish completely.

Following our letters of the previous month, I am sending this one to find the address your  
nephew Nikola Tesla from other sources and our kin do not know. We are returning the letter so  
that you can arrange for Mr. Tesla the subject matter, so that maybe you will want to change  
something before it is mailed.

President, N. N. Sec. N.N  
N. Tesla, Hotel Waldorf Astoria, 5th Ave & 34th St, New York  
Most Egregious  
Mr. Tesla, Electrical Eng,  
Hotel Waldorf Astoria  
5th Ave. & 34th St.  
New York, NY



Tesla's Correspondence with Relatives--Page 151

Angellina Trbojevic to N. Tesla  
Tesla's sister; Wm Terbo's grandmother

Medak, Lika, Croatia  
Marj 21, 1910

My Dear Brother Nikola!

A long time has passed since not even one word was exchanged between you and me. Since it is known that you and I are brother and sister, and how much we like each other, then it is really strange! I shall not reproach you, because, I know your situation and my sisterly heart tells me that we are true brother and sister as I when we were together.

Dear Brother, I shall report in short how I am living. My Jovo (Terbo's grandfather) a parish priest (Very Rev.) in Lika and now in Medak; I have 3 sons Petar, Uros and Nikola (Terbo's grandfather). Uros completed law school; Petar became a monk and is now Proto-Sindjel (Monsignor) Dr. Juns in Theology. Nikola (Terbo's father) completed mechanical engineering in Budapest. I have two daughters Marica & Milica. As you can see by the postcard Marica is getting married. The younger Milica goes to IV... high school in Budapest. We are all well and we would be happier if we knew that you are well and content.

For this reason I write.

Accept love from my children, Jovo and me and greetings.  
Your Sister, Angellina.

page 152

Anka Babic to N. Tesla  
Tesla's cousin

Staro Selo, Croatia  
Dec. 24, 1911

Dear Nikola!

You will be surprised from where this letter is coming and I shall make it clear.

I am the youngest daughter of your Aunt Smiljana, the widow and am married to Ljubomir Babic, a priest.

I am writing to you to ask you one favor at my mother's request. About 15 or 16 years ago here a law was passed that any woman who marries a priest must pay 500 Forints into a widow's fund in case the husband dies. She has a right for an inheritance to the children; My mother had to pay for all of the expenses for my marriage. She always said when you have the greatest need turn to you, because, you told her of her love for you and you helped your late sister Milka.

With this dear cousin, mother and I ask of you if in any way possible to do this favor. We are now in the greatest need and by the end of the year it must be paid.

Both of us have hope if at all possible you will not let us down and you did not forget you kinfolk who never offended you. I hope the sooner the better help comes from you. Warmest of Greetings.

Mother & your Cousin. Anka Lj. Babic,  
Staro Selo  
Posta Blina, Banja, Croatia



Tesla's Correspondence with Relatives Page 153

Marica to N. Tesla  
Tesla's sister

Rijeka(Fiume), Italy  
Dec. 9, 1912

My Dear Brother, Darling Nikola!

After many years in the first place I want to congratulate you on your Nameday(Dec. 19 St. Nicholas). May God grant you good health & contentment for a long time for the sake of humanity. After these formal greetings-for myself I must write about other matters and I have little desire but you will make me very happy with a single reply. I read occasionally in the newspapers about you. Dr. Subotic from Belgrade saw my son Milutin who visited you last summer and said you are well, Thank God. I have sometimes and it was long ago I wrote and because you did not reply, I knew that you were very busy and I didn't want to bore you. Now, when I heard about you, I took the occasion of your Nameday(and without him to wish you for myself) I write. I am fine for my situation. The oldest son Ljubisa is a First Lieutenant. Milutin received his Doctor of Medicine 2 months ago and when the First Balkan War-1912-broke out he went to help his brother Serbs in Belgrade.

Dr. Subotic is Primarius in this hospital and talked about you to Miso-that is what we call him-and your nephew Dragisa & little Sava(18) are still in school. I don't want to bore you with daily events so you will not be angry. Angelica, Jovo and all their children are well. My sons are well, only our Maja passed away. My dearest brother don't be angry with me, that I want so much to

page 154  
if I write a letter. Sisterly Greetings. I am free now to send you 2 or 3 books in Serbian & Croatian literature.

PAGE 155 IS IN ENGLISH  
(Ed. note-translator NK-This is Wm. Terbo's father who wrote his first letter in English from Budapest)

are in English

Page 156 & 157

Page 158  
Angelina Trbojevic to N. Tesla  
Tesla's sister(Wm. Terbo's grandmother)

Medak, Lika  
Jan. 28, 1914

Dear Brother Nikola!

Please be good and pay strict attention if you intended to do me some good, help the boy in your firm. I know this would be the best school for him. (Nikola Trbojevic-Wm. Terbo's father and Angelina's son). I know this would be the best school for him and we would be happy and at peace.

If however this is not possible, then try to find him a good firm where he would like to work. I don't doubt it that he would succeed and advance himself for the future.

We are all well and living comfortable and Niko will tell you about the kinfolk.

Accept Greetings from Jovo, Your faithful sister, Angelina.

PAGE 159

Nikola Trbojevic to N. Tesla  
Tesla's nephew(Wm. Terbo's father) Nov. 10, 1915

217 E. Erie St.  
Chicago, IL

Dear Uncle:

Your latest success made me very happy. I, from the bottom of my heart, congratulate you on your deserved honors. LONG LIVE MY FAMOUS UNCLE!

Your Faithful, Nikola Trbojevic

PAGE 160 IN ENGLISH



Njegovan, Vladimir. NIKOLA TESLA - HEROJ TEHNIKE  
Prosvjeta, Zagreb, 1950. Pp. 54.

Description of contents, pp. 46-50:

[Tesla always demonstrated unusual physical vigor. He would talk about living to an age of 150 years.]

[On his 70th birthday the Zagreb University conferred an honorary Doctor of Engineering degree. Prof. Calogović was to present the diploma in person. Tesla invited him to dinner at his Hotel, and stated that he could not alter his mode of life to accommodate his guest. He ordered the dinner as usual, with the food to contain the specified number of calories and vitamins. During the evening Tesla told the visitor much about himself.]

[Prof. Franjo Hanaman, whose system of electrical lighting is still in use, of the Technological Faculty of Zagreb, also visited him; also, Prof. Milan Vidmar, chess expert and author of major works in electrotechnicity. He was also regularly visited by P. Radosavljević, the professor of psychology and pedagogy. ]

[p. 47: The Association of Engineers celebrated his 70th year. He expressed his thanks via radio, June 28, 1926. ]



Tesla's Correspondence with Relatives PAGE 162  
Nikola Lalic to N. Tesla  
Tesla's great nephew

Sarajevo, Bosna  
Sept 20, 1920

Dear Sir Granfather!!

I believe that you will be very surprised when you read these few words, because it is rare to receive letter from here, your homeland.

Your sister Milka, My grandmother, left this world before this terrible war was concluded, whose consequences a little later death took her daughter, my mother. I hardly remember her. I graduate this year which is later due to the war interrupting my education.

The war was on all sides in our area and we removed the German nemesis and the Austrian bayonet. The results of the war caused alot of corruption of the State marketing systemimorality, in short extreme corruption. My stipend is \$20 US yearly and conditons are intolerable that one cannot live under such unstable conditions and what is worse, when one has to do such work as spintual work.

I can write a war drama, which is becoming tragic and I do not want to bore youe you. Accept my Greeting and Love as an expression of my respect for you.

Your great nephew, Nikola, high school student.

My address: Lalic high school Viii grade, Sarajevo, Yugoslavia.

PAGE 163 IS IN ENGLISH PAGE 164 IS SERBIAN EQUV..

Fanika Tesla to N. Tesla  
Tesla's neice

Ruma, Serbia, Yugoslavia  
Feb. 1, 1922

Very Resped Uncle!

I have been preparing to write for a long time. I did not know the exact address; today, I have it and here I humedly write to you.

Do you remember me?-or I don't knowas to your fame and newspaper articles which makes you very busy and forgot me

I am the daughter of your Cousin Milutin. My father died in these wars and left me and my mother. I would like to isit you only if you want me and confirm my coming. With my letter I am sending a picure of your cousin Milutin and his baptism papers to show you I am writing the truth.

Many Greetings from your Neice, Fanny Tesla

Ruma 1901. Milutin Tesla was born in Bjelovar, 1854, Nov. 23 died Ruma 1914-parents Marija Tesla.

PAGE 166

Angelina Trbojevic to N. Tesla  
Tesla's sister(Wm. Terbo's mother)

Medak, Lika, Croatia  
July 1926

My Dear Brother Nikola!

I haven't written to you in a long time; the reason is is that you are very busy with your scientific work and articles. I follow your career in the press about every progress. I am with you in spirit my dear Nikola and I cry from hapiness. May God grant you a long life and good health and it is our most desirous wish.

I am well with my 5 children, thank God that they all succeeded. Marica is well with her 3 sons. Be well brother Nikola and successful! Always thinking of yhou.

Love, Sister angelina.

P.S. Accept greetings & sincere wishes from Jovo and all the children.



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 167

Marica Kosanovic to N. Tesla  
Tesla's sister

Rijeka, Italy  
Sept 20, 1926

My Dear Nikola!

I thank you now dear brother for your kindness & nobility! I can say that decades have passed and I haven't more happy and encouraged when your recognition by the Engineering Society then when I received a reply from my postcard on your Nameday; I was refreshed and energized. Thank you dear Nikola; a thousand thanks! I am lucky that I came in contact with you, lucky believe me! Sava feels the same and my sons also. I shall spend the money with your approval for my medical expenses. I came with Dragica, Milutin and Sava to Rijeka for a few days at Sava's so we can bid bon voyage to Sava who is going to America on a political mission and in the main to congratulate you on your 50th birthday (dear Nikola). The Ministry of Social Politics, the largest national institution of National Defense, the Belgrade editors of newspapers & others and above all else, everybody to greet him. He will visit many Serb colonies to see the latest situation. He looks like our late grandmother, a complete idealist like the rest of us. I beg you to accept him! He is already like a journalist & fighter-answers his questions, like those that are needed here. The cult of Nikola Tesla is rising and his homeland and what is up to now passed with the beginning lectures of some scientist about you which is propagated all over to popularize your name & works. Because, our nation needs and I beg of you as a sister to help our brothers in these times. I know that every minute is precious to you and do me a favor and listen to him.

Thank you very much and love your noble soul, Sister Marica  
(Translator's note) Sava Kosanovic visited the U.S. and met with Tesla for the first time in New York.

PAGE 168

Sava Kosanovic to N. Tesla  
Tesla's nephew

Hotel Navarre  
7th & 38th St., Room #123

Noble Uncle: He used the colon, Ed note

I came from the fatherland expressively to offer greetings from the Ministry of Social Politics of National Defense and from the editors of our most respected newspapers and other Tesla worshippers-in the first place Greetings from your dearest ones. I ask of you if at all it is possible to meet me some time and if you would accept me without bothering you.

I have a letter from my mother Marica & Aunt.  
Your Nephew, Sava Kosanovic, Ph.D., youngest son of Marica

PAGE 169

Sava Kosanovic to N. Tesla  
Tesla's nephew

New York, NY  
Oct. 10, 1926

Honorable Uncle:

I am taking the liberty to tell you that on Oct. 17 I shall go to Pittsburgh where I was invited and I will be occupied for a short time.

When I return, I shall be free to see you and ask you to receive me.  
With Greatest Respect, Your Nephew, Sava Kosnaovic

Page 170

Sava Kosanovic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Dec 4, 1926

Letterhead: Nikola Trbojevic, M.E.  
71 Glendale Ave  
Highland, MI

Dear Uncle,



In my travels across America, I came to Detroit to visit Niko. He is well and is very successful. He has a strong inventive vein. We spoke much about you and thought of you. I shall visit a few more Serb colonies these days, then, I will arrive in New York to return back to our fatherland. I will be at liberty to see you.  
Please, dear uncle send your picture sso that when I go to Europe to show our kinfolk and the whole nation.  
Respect Your Highly Greetings, Your Nephew, Sava Kosanovic



Sava Kosanovic to N. Tesla  
Tesla's Nephew

page 171

Hotel Navarre  
7th & 38th St. Rm 4405  
New York, NY

letterhead

New York, NY  
Dec 16, 1926

Noble Uncle

I returned today from my tour of Serb colonies. I will go to Europe Dec. 23. I am at your disposal to accept me before departure.

Greetings, Your Nephew, Sava N. Kosanovic

Nikola Trbojevic to N. Tesla  
Tesla's Nephew

page 172

Paris, France  
Aug. 15, 1927

postcard:

Mr. Nikola Tesla, Pennsylvania Hotel, NY < NY USA

I am just starting for Berlin and Yugoslavia. Wish you were with me.

Yours Affectionately, Nikola Trbojevic

Nikola Trbojevic to N. Tesla

page 173

POSTCARD

Berlin, Germany

Mr. N. Tesla, PA Hotel, NY < USA

Arrived here from Paris O.K. in a Farman airplane. Will tell you all about it when I return.

Sincerely, Nikola Trbojevic



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 178  
Telegram in English -WESTERN UNION  
N. Trbojevic to Tesla  
Tesla's Nephew

Sept 10, 1928  
Detroit, MI

Nikola Tesla Hotel Pennsylvania  
Hear you called will be in plant all day tomorrow, Nikola

N. Trbojevic to N. Tesla  
Tesla's Nephew

PAGE 179

Detroit, MI  
Sept 11, 1928o

Letterhead-Timken-Detroit Axle Co, Gen. Offices  
100-400 Clark Ave.  
Detroit, MI

Dear Uncle:

I am now sending \$1,000 as we had decided today on the telephone. The other \$1,500 I will send as soon as I am able to.

My work is going well and now I finally completed my "gear hob" that cuts spur and helical gears by a tenth of "tool cost" than before. I have hope that I will be successful with this at Ford co.

How are your? Are you well? All at home are well and always ask about you in their letters. My wife went to California for a month. She Greets you and your nephew hugs you, Niko.

PAGE 180

Nikola Tesla to N. Trbojevic  
Tesla's nephew

New York, NY  
Sept 13, 1898  
(may be error?) (1)

Inclosure, Copy of Resolutions of Board of Dir.  
Timken Co. meeting Sept 19 1928

Dearest Newpew,

With a handshake I am sending approval of our verbal understanding the manufacturers think that my instrument is something divine and will be easily sold. It looks like one can anticipate a good income.

I displayed the technical designs of my helicopter plan which will be interesting to you. The patents were accepted and firmed, because, similar results cannot in another way or with the help of others be achieved. The machine can be used like an automobile but let that be between us.

I am happy about your success not because you are acclaimed but, you completed something that will be honorable to you and our people. If it is possible to do without harm in the precision of your discovery will be very important not only for military use but cheaper that costs will be cheaper-they can be built in small factories where the work changes every day.

Since I telephoned you I discovered some processes of unbelievable value and I hope it will be shortly in a position to give to the world my best work i.e. Wireless Transmission of Power.

PAGE 181

I thank you very much for calling me immediately and I remain with Greetings.  
Your Honorable Uncle,

(1) Tesla's letter has Sept. 13, 1898 date;. It looks like it was more like 1928.



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 182

N. Trbojevic to N. Tesla  
Tesla's Nephew (Wm Terbo's father)

Detroit, MI  
Sept 19, 1928

Dear Uncle:

I received your letter and that approval I shall send you the balance as soon as I get things in order.

I am at the moment discussing with General Motors for a new steering gear for the Cadillac. The will be a combination of a globoid worm and helical gear sector; the worm to be made of bronze and the sector, hardened steel & ground. This all goes with some of my patents and I hope to receive at least \$20,000 to \$30,000.

My work is going well, only that I am a little tired. You know yourself how constant worries and concentration debilitates the human organism.

I read your patents about the helicopter; do you think the machine will have enough power to pull an aeroplane without wings, i.e. when it rises? Did you do something of this up to now?

I am pleased that you again achieved something in the transmission of power without wires. That is in fact your real discipline and in this you will achieve results the fastest because you are a powerful specialist in that, I am in view of experience that you work the best in one discipline..

Warmest Greetings, Your Nephew, Niko

N. Tesla to N. Trbojevic  
Tesla's Nephew

PAGE 183

Hotel Pennsylvania New York, NY  
Sept. 20, 1928

Dear Nephew, (In Serbian the vocative or address is followed by a comma)

I received your yesterday's letter and I thank you that you are concerned about me. I need money however and please do not sacrifice yourself.

I have to explain the situation (with you a few words). We received from the Waltham Watch Co., for a very limited rights for this my invention - \$160,000 and will get the same amount before the main patent runs out. The new field is much bigger and income will be greater. I am waiting at least 30 to 40 thousand dollars a year, especially, since I found one fine improvement which is easily understandable. These are two equal surfaces nearby - not in touch with each other. One moves and transmits to the other about an air path - effort is vigorously<sup>12</sup> proportional in size and speed moving on the surface. I have now arranged that work<sup>13</sup> active<sup>1</sup> of area can arbitrarily<sup>15</sup> change and that now speed RPM<sup>16</sup> no matter what kind, in a moment can be read on the same scale without any<sup>17</sup> changes; only multiplied by two, etc. That will create a sensation.

You are now<sup>18</sup> in the same phase of life that I had passed. Your work has been so intensive that you think about nothing else. At one time understood<sup>19</sup> seen<sup>10</sup> that you have a large income and fame cannot remove that from you now<sup>11</sup> are under sail into large<sup>12</sup> reactions which are more powerful than than you think. One must<sup>13</sup> energetically struggle<sup>14</sup> against poisoning. Change your work; take long walks; eat the best food and all at a slower pace. It would be fine that you read light material which is humorous which does not danger your health

PAGE 184

I Remain, Your Uncle Nikola.

1. added inserted; 2. same as 1; 3. same as 1; 4. & redrawn; 5. redrawn; 6. added; 7. redrawn; 8 & 9, same as 7; 10. added; 11. same as 11; 12 redrawn; 13 underlined; 14. redrawn.



Tesla's Correspondence with Relatives PAGE 186  
N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Sept. 24, 1928

Dear Uncle:

I received your kind letter of Friday and thank you for the advice on health, diet, etc. Your RPM motor looks very good to e. This will truly be a beautiful instrument for every ship and especially when it is used for all speeds.

I had made a fine deal with General Motors. Last Friday we brought the deal to a head (which is not signed but this is only a formality) with which they will complete my "steering gear" in their Steering Gear Division. Saginaw, MI. They now have an option for no-exclusive \$100,000 and exclusive \$200,000 or royalty which brings about \$10,000 monthly. Besides this, they pay me \$500 monthly for 'const' consulting. I spoke with a handshake with Mr. Seaholm, Chief Eng. of Cadillac Motors. He knows of you.

You can see things are going well. I shall send you money in a day or so. I have \$16,000 in cash, but, I erroneously loaned all and it is difficult to collect when one need it. I loaned money for the Serbian Church in Detroit which was \$5,000 loan (in January) and they are not paying anything. They are building now a new Church "Ravanica".

I still hold my job at Timken and will get a large sum of money from them if the new "real axle" is used. This is a globoid gear which can be made simply and precisely. It may be that this gear will be good for your aeroplane, and I can make with shafts at any angle from 45° to 90°.

PAGE 186

TELEGRAM: WESTERN UNION; NEW YORK, NY SEPT 25, 1928  
Nikola Trbojevic, Timken-Detroit Axle Co.

Detroit, MI

I WARMLY CONGRATULATE YOU ON YOUR EARNED SUCCESS. I AM PROUD AND AM HAPPY THAT MY DEAR SISTER GAVE SUCH A VALUABLE & CAPABLE SON TO THE WORLD.

PAGE 188

Nikola Trbojevic T N. Tesla  
Tesla's Nephew

Detroit, MI  
Sept 29, 1928

Dear Uncle:

I just returned from Saginaw, MI where I worked a whole week with GM and found your telegram. Thank you very much for remembering and will be well -if God wills it.

We had drawn a new "steering gear" for Cadillac, LaSalle & Buick Master Six and already ordered tools & materials that are needed. As you can see we are working very fast. The new "gear" looks very good on paper and I am completely satisfied up to now. My only worry is that the patents can hold up under bombardment which will undoubtedly come as soon as this is public. Be that as it may, we shall have a better steering gear up to now and I am convinced.

Alice (my wife) came back from California very tired and thin which she likes. Little Jackie is on a farm for a few more days, then, he will go to school. He was already in school (nursery school) 6 months and got a 147 IQ on an intelligence test - highest in school. It looks like he will be good. That Lika blood of ours looks better than the Anglo-Saxon. We must be some sort of superior beings under Mount Velebit and Mt. Kapela.



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 198  
Nikola Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Oct. 5, 1928

My Dear Uncle:

I have just received your kin dletter of Wenesday and I received you letter in English yesterday. I am so pleased to hear our inventions are coming out so wwell and all will be beautiful.

That article in Popular Science is very nice and I have already sent a copy to my mother in Medak, Lika and one to Marica Kosanovic i Plaski, Lika.

My "globoid worm" is being cut in an ordinary hobbing machine by means of a helical cutter. I place the cutter where the work is now and the gear to be cut; the worm is now where the hob was; and gear up the index l& feed to produce the required twist of helix. The worm is so cut be a tangential feed, i.e. the center distance does not change during the process of generation. This works fine and I can produce a globoid worm faster, better and cheape than the usual worm or screw. Such a worm (globoid) meshes with a line contact at all times with a common helical spur gear, whereas, a straight worm (...) with a pont contact can do the same.

It seems to me that since I began working with you my luck has turned around and now everything goes well & beautiful. Is would please me most if this happened to you i.e. I bring you some luck. Warmest Greetings, Your Faithful, Niko

PAGE 197

N Tesla to N. Trbojevic  
Tesla's Nephew

New York, NY  
Oct. 8, 1928

My Dear Nephew,

I am very happy when I read in you last letter the genial way in which you use in solving you intentions and I couldn't find a word 'in al even though I looked long and hard in the hope that I tell you in advance<sup>3</sup>. You will achieve great renown rapidly buth think what I shall get when my new process begins to form. I don't need everything more when the income from railroad rails come in-they will be much stronger, non-corrosive,...) and unbreakable. It develops according to laws of nature i.e. slowly for about 6 or 7 months which are difficult and heavy. I don't like to mention it is mostly true that I am \must\ awaiting acceptance of the whole amount immediately, because, the manufacturers, want to begin production; as for me it is indispensible. Necissity that I receive money from you as soon as possible. He is the clear picture if the situation and you do what you can.

Warmest Greetings., Your Uncle, Nikola

PAGE 198 IS IN ENGLISH

PAGE 199 IS IN ENGLISH

PAGE 200

N. Trbojevic to N. Tesla  
Tesla's Nephew

Hotel Statler, Buffalo, NY  
Oct. 11, 1928

Dear Uncle:

Here I am at the Convention of American Gear Association. I shall begin work here on 2 more patents; one is a special Fellows Cutter for cutting continous tooth herringbone(stylus) gears and the other is the solid worm clearances hob. You see that I work mercilessly just to penetrate or be swallowed.

Greetings, Your Faithful, Niko



Tesla's Correspondence with Relatives PAGE 189

I shall send your elegram to my mother. This will bee dear to her and more than all the gold in the world. She loves you more than her own children and you have upset her it looks to me. What do you say that we take a nice car and take our time traveleing through France, Switzerland, Italy and Yugoslaiva? We can do all of this in 6 weeks or two months. <sup>17</sup> We shall take Alice I & the little boy(Wm. Terbo was born in 1930-this is 1928)., Many Greetings,Niko

N. Tesla to N. Trbojevic  
Tesla's Nephew

PAGE 190

Hotel Pennsylvania  
Oct 1, 19928

Written in English

PAGE 191-192 (TRANSLATION INTO SERBIAN OF 190  
page 193

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Oct 2, 1928

My Dear Uncle:

Hewre I am remitting a check for \$500. I am holding this strictly confidential and did not tell Alice nor anyone elsse about our business, Wish you Health & Luck, Niko

N. Tesla to N. Trbojevic  
Tesla's Nephew

PAGE 194

Hotel Pennsylvania, NY  
Oct. 3, 1928

My Dear Nephew,

I received your yesterday's letter & check for \$500 i.e. \$1,500 up to now. As I telephoned you not long ago I need \$2,500 for construction of the first model for sale. I began the work immediately because time is costly and therefore I need the whole sum:

This is a very good invention \and could be produced in large quantities\<sup>2</sup> your income will not be less than \$10,000 per year. If everything comes out well with GM this will be "carfare" for you.

I didn't [...] your letter from last Saturday \ which made me very happy \ I wrote you a few words in English intentionally. As a correction for [...] people not to expect too much. In your field(discipline) cannot be maintained \some kind of \ completed new principles. \mechanics\<sup>6</sup>. It is enough that you find and \<sup>7</sup>secure \some kind \<sup>8</sup> better construction. I am surprised how this gloular gear care wsorks \. It is obvious that \<sup>9</sup> has a very small number of ways and it looks like that \<sup>10</sup> good patents \receive\ <sup>11</sup>.

I think that I didn't clearly express \ in view\<sup>12</sup>those new processes of "invaluable" value. They don't have a connection to the transmission of power without wires. They are producing all kinds of materials except metals. For example, Iron of this type can have \greater\<sup>14</sup> tensile strength and [...] it looks like silver and will be noncorosive and \it will not cost more \<sup>15</sup>. But this is nothing. You will see its great wonders. Do not speak of this.

I wish you the best of success. I Remain your Uncle, Nikola.

1.inserted	2. inserted	3 instead of redrawn\$10,000	inserted	5 inserted
6redrawn	7 inserted	8 redrawn	instead of redrawn secure	11 redrawn
12 instead of what matters		13 inserted	14 in place of	15inserted



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 198  
Nikola Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Oct. 5, 1928

My Dear Uncle:

I have just received your kin dletter of Wenesday and I received you letter in English yesterday. I am so pleased to hear our inventions are coming out so wwell and all will be beautiful.

That article in Popular Science is very nice and I have already sent a copy to my mother in Medak, Lika and one to Marica Kosanovic i Plaski, Lika.

My "globoid worm" is being cut in an ordinary hobbing machine by means of a helical cutter. I place the cutter where the work is now and the gear to be cut; the worm is now where the hob was; and gear up the index I & feed to produce the required twist of helix. The worm is so cut be a tangential feed, i.e. the center distance does not change during the process of generation. This works fine and I can produce a globoid worm faster, better and cheape than the usual worm or screw. Such a worm \globoid\ meshes with a line contact at all times with a common helical spur gear, whereas, a straight worm (...) with a pont contact can do the same.

It seems to me that since I began working with you my luck has turned around and now everything goes well & beautiful. Is would please me most if this happened to you i.e. I bring you some luck. Warmest Greetings, Your Faithful, Niko

N Tesla to N. Trbojevic  
Tesla's Nephew

PAGE 197

New York, NY  
Oct. 8, 1928

My Dear Nephew,

I am very happy when I read in you last letter the genial way in which you use in solving you intentions and I couldn't find a word \in al even though I looked long and hard in the hope that I tell you in advance\<sup>3</sup>. You will achieve great renown rapidly butth think what I shall get when my new process begins to form. I don't need everything more when the income from railroad rails come in-they will be much stronger, non-corrosive,...) and unbreakable. It develops according to laws of nature i.e. slowly for about 6 or 7 months which are difficult and heavy. I don't like to mention it is mostly true that I am \must\ awaiting acceptance of the whole amount immediately, because, the manufacturers, want to begin production; as for me it is indispensible Necissity that I receive money from you as soon as possible. He is the clear picture if the situation and you do what you can.

Warmest Greetings., Your Uncle, Nikola

PAGE 198 IS IN ENGLISH  
PAGE 199 IS IN ENGLISH  
PAGE 200

N. Trbojevic to N. Tesla  
Tesla's Nephew

Hotel Statler, Buffalo, NY  
Oct. 11, 1928

Dear Uncle:

Here I am at the Convention of American Gear Association. I shall begin work here on 2 more patents; one is a special Fellows Cutter for cutting continous tooth herringbone(stylus) gears and the other is the solid worm clearances hob. You see that I work mercilessly just to penetrate or be swallowed.

Greetings, Your Faithful, Niko



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 201  
N Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Oct. 19, 1928

LETTERHEAD TIMKEN-DETROIT AXLE CO.

My Dear Uncle:

I received your letter of last week when I was in Buffalo at the convention.  
Here I am sending \$500 for our account and the other \$500 as soon as I get money fro GM  
which will be probably next week.  
How are you? Your new metal gear and especially steel will be a colossal thing. Ford Co. will  
give you millions for non-corrosive steel, becaluse lost the litigation in these patents and paid a  
large fine.

However, uncle just hold on. This will be somethin phenomenal/ Hug Your, Your NIKO

N. Terbojeic to N. Tesla  
Tesla's Nephew

PAGE 202

Detroit, MI  
Oct 27, 1928o

My Dear Uncle

Last week on Oct. 19, I sent you \$500 for your account. I don't know if you received it. Letter  
was special Delivery.  
How are your? I am not well and have something in my stomach. I cannot eat and vomit  
often. Now I have a good doctor who is examining me. I hope that it is nothehing serious.,  
Your Nephew, Niko

PAGE 203

WESTERN UNION TELEGRAM

N. Tesla to N. Trbojevic  
Tesla's Nephew  
TO: N. TESLA

New York, NY  
Oct., 29, 1928

I couldn't recognize that great invention are incomplete. Take care of your health. Write to me  
about the symptoms of health & life style... Uncle

PAGE 204

LETTERHEAD TIMKEN-DETROIT AXLE CO.

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Oct. 31, 1928

Dear Uncle:

I received your telegram yesterday. Thank you with respect to health. I have an ulcer the  
doctor says in the stomach-one in the duodenum and analysis looks not the best. Now the  
doctor put me on a strict diet with only cream, milk and strained oatmeal and calcium carbonate  
night and day in addition..

I have good doctors; Prof. March for internal and Dr. Evans for x-ray. As they tell me that I  
have a good chance to not have an opeation which would be partial removal of the stomach.  
My work is going well. Everything at GM looks fine, but the contract is not made up and signed  
as yet. At Timken, I am completing this wek a rear axle for Stutz that will be the new worm gear.  
For that spur gear of mine, I have 2-3 prospects and I will sell it in due time. This week I  
patented a new transmission for automobiles, sliding gear type and synchronized prior to shifting  
to avoid the clasing of teeth. My wife and the boy are well but=I must recognize she is a little  
nervous. These international marriages are not so simple like ours and American women are  
difficult to satisfy. . Hug You, Niko.



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 205  
N. Tesla to N. Trbojevic  
Tesla's Nephew  
Nov 3, 1928

Hotel Pennsylvania  
New York, NY

My Dear Nephew,

I was really was just reading your letter of 31st of last mont. Is it that you did not think it relevant? But, because of this it looks that your illness is a consequence thereof<sup>1</sup> is a weakness and not life threatening. I did not need a doctor for 50 years, because, I cure myself alone and you can if you want to.

Because you are in the hand of specialists, it is difficult for me to advise you on the basis of my experience. Americans are good in surgery even if they risk too much. They<sup>2</sup> with respect to internal illnesses, I would have more faith in European doctors who do not give such tremendous doses.

I don't know why you need so much calcium carbonate. This does not dissolve in water when it contains  $CO_2$  and then it converts into bi-carbonate. You have sufficient calcium in milk and it is the best form. Our waters are very hard. Many hold<sup>3</sup> that calcium makes stone in the kidneys and offends all paths of blood flow.

The cream made here is dangerous (...) the way it is made here and does not have enough proteins and it is easily picked up and does not have bacteria.

Oatmeal makes too much acid. Milk is very good to drink as much as you want but in every pint 130-132 grams of fat.  
( 1 gram = 15/16 grains.

Your body demands more<sup>4</sup> (...). olive oil and I found a wonderful combination. Take celery and a capsule of same measurement then

PAGE 206

cut up very fine and cook well with a lot of butter (necessary)<sup>5</sup> proteins are best from egg whites (egg has about 60 grams of protein) and cook in the "Bain Marie" (some kind of pot, Tr. note) way. Put a pot with water and cook the white of the egg for a few minutes until it hardens. This is the easiest way to cook them and it does not make wet acids.

I hope that in view of your work all is running smoothly but health is first.

In a previous letter you surprised me that it brought you luck. That is true and I can tell you with my mechanical theory of life.

Wish you well and a fast recovery. I Remain Your Faithful Uncle Nikola  
1. write across general 2. written over 3. in place of 4. in place of redrawn 5. redrawn

PAGE 207

N. Trbojevic to N. Tesla  
Tesla's Uncle

Detroit, MI  
Nov. 8, 1928

LETTERHEAD-Timken-Detroit Axle Co.

My Dear Uncle:

I received your kind letter of Nov. 4, 1928 and thank you very much for your advice relative to my illness. It is not as dangerous one would think and the pain has ceased. The doctor says that an operation is not necessary and the ulcer will heal in 2-3 months and possible sooner. He maintains that calcium carbonate serves as a cure against ulcers and prevents the formation of acids in the stomach. Oatmeal forms an emulsion with calcium which covers the ulcer and it heals easier. Calcium Carbonate<sup>1</sup> does not go into the kidneys or heart, he thinks.

Discussion with General Motors is completed and will be signed in the next 2 or 3 days. That will be fine. My wife is very nervous. She has a form of split personality and I cannot figure her out.

You don't write about your work; I hope it is going well. Warmest Greetings, Your Niko 1.  
redrawn



Tesla's Correspondence with Relatives PAGE 208

WESTERN UNION TELEGRAM

N. Tesla to N. Trbojevic  
Tesla's nephew

TIMKEN DETROIT AXLE CO.

New York, NY  
Nov 9, 1928

Your letter made me very happy. I was afraid of the danger as followed in the letter but one must react along with local locality through blood relations to know your private address. Greetings Nikola

PAGE 209

N. Trbojevic to N. Tesla  
Tesla's nephew

Highland Park, MI  
Nov 16, 1928

My Dear Uncle:

I received your kind telegram a few days ago. The illness is still with me i.e. I am still on a diet, but, I feel much better. I sleep well and I am not losing any weight.

How are you? My contract with GM was signed 14th<sup>1</sup> but I still did not get the check for the last two months. This check is coming from the Saginaw Division and I shall immediately send you \$500.

Now it looks like I will have another deal with GM for my process of hobbing. Engines are already have been approved but I must go through the Chief Engineer of Chevrolet (Mr. Hunt) and the lawyers. At Timken things are fairly well and this new gear axle will be consummated.

Thank you very much for your interest. Now we are in the illness family - all 3 are ill. My wife has some kind of thyroid problem; poor metabolism and the little boy (Jackie) coughs and has a cold. Our life must look difficult to you and impractical. I feel fortunate and normal when I work on my problems and when I come home in the evening I get a strong depression and I feel myself<sup>2</sup> that I am in some cemetery. Write again. Warm Hugs, Your Niko

PAGE 210 IN ENGLISH

N. Tesla to Alice Trbojevic

N. Trbojevic's wife (Wm. Terbo's mother)

Hoel Pennsylvania,  
NY, Nov. 20 1928

PAGE 211 IS TRANSLATION OF 210

N. Tesla to N. Trbojevic  
Tesla's nephew

Hotel Pennsylvania, NY  
Nov. 21, 1928

My Dear Nephew:

As I told you before I work continuously on those important inventions that I have forced such momentum and could not complete<sup>1</sup> from the left or right. One who is great must have cost me millions that<sup>2</sup> that I will have them<sup>3</sup> become rich if I was an opportunist. In short I will meet with the powers that be - engineers<sup>5</sup> to be everything in flux and find all kinds of capabilities. These people are awful known-nothings and again fear anything new to propose because<sup>6</sup> they think only for their own skins. It is very difficult to find a man who has all three qualifications: knowledge, truth and unselfishness.

Much<sup>7</sup> pleases me that you finally come to an agreement with GM and I think that your work at Timken will be crowned with success. With these beautiful<sup>8</sup> acquisition you can build something large.

Do not neglect hygiene because your life now is important<sup>9</sup> value for your discipline and you have a greater future. Only do not allow your spirit of Trojeviches fill up<sup>10</sup> according to capabilities and least of all the will of your wife and you can go to the limit following my formula a that<sup>11</sup> that you cannot extract an income to throw out the wind from morning to night.

Warmest Greetings, Your Honest Uncle, Nikola.

PAGE 213

1. inserted diagram 2. same as 1 3. inserted 4. inserted 5. redrawn 6. inserted 7. in place 8. inserted 9. in place 10. inserted 11. same as 10 11 same as 10 12 same as 10.



Tesla's Correspondence with Relatives PAGE 214  
N. Trbojevic to N. Tesla  
Tesla's nephew

Saginaw, MI  
Nov. 28, 1928

Dear Uncle:

Here I am today in Saginaw where we are working on a steering gear for Cadillac. I received your letter last week. As you told me yesterday on the telephone and as I told you I thought that I would get the check here in Saginaw for \$1,500. But they told me that all the papers were sent to the legal department in Detroit where I shall be paid. Meanwhile those in Detroit say that I should be paid in Saginaw. Here is some confusion and as soon as I find out where my check is, I shall send you \$500 immediately which will be Friday. Tomorrow is Thanksgiving Day. I feel much better now and still am on a diet and will have to be careful for a few more months. However be patient for a few days. I shall send you the money.  
Now I am very busy, Love Your Niko

N. Trbojevic to N. Tesla  
LETTERHEAD

PAGE 215

Highland Park, MI

My Dear Uncle:

You will be surely surprised how I don't keep my promises about the \$500 and it still is in our account. I had hoped that I would get the money from GM long ago, but somehow, it is difficult to get this check. According to our first understanding of September 21, they were to pay me \$500 monthly salary for consultation but not one cent did they pay me<sup>1</sup>. Just a week ago they asked me if I would accept at least \$3,000 as an option in lieu of salary for a year. I said yes, because, *need* the money. The lawyer said the check would be sent immediately, but already, six days have passed and still no check. You wouldn't think that the GM company would use such tricks. However, I must get this money eventually, because, I have a contract, black on white. My wife & Jackie are both sick with colds & fever. My stomach is much better, but, I am still on a strict diet. How are you?? I shall send you that \$500 as soon as I get it from the source.

GM had installed two of my new steering gears in their experimental cars and are test driving them. It looks good up to now and those in Saginaw think that all will be well.

Now, I have another contract (still not signed) with GM for my new gear process (hobbing). I will have to work on this about three weeks and hope to succeed. If this goes well, it will be worth \$50,000 a year or more.

PAGE 216

Now, I have another new idea for bearings, especially for crankshafts, and connecting rods. I have not patented this yet.

I also have  $\text{val}^2$  synchronized the shifting gear transmission which is now being tried on the Oldsmobile. The idea is a little crazy, but, it is possible that something will come out of this.

I am in trouble at Timken. I cannot produce these new worm gears accurately. Now, I am working on this feverishly, but, I am afraid that I will need new and stronger machines.

Write again how our work is coming along. Not even God would allow your steel to burn. This would be fine. Many Greetings Your Niko



Tesla's Correspondence with Relatives PAGE 217  
N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Dec. 18, 1928

Dear Uncle:

Here I am sending a check for \$500 which will complete that \$2,500. Finally, I got a check from GM \$3,000 which will be in place of a \$500 monthly consultative fee. My other things are not going so well at Timken, I still did not succeed; that transmission (synchronized) is yesterday's<sup>1</sup> refused by GM. My health is much better and stomach does not pain me, even though, I am still on a diet.

How are You? I know that you will succeed with your big projects. Love & Greetings, Nikola  
1. inserted

CABLEGRAM

N. Tesla to Marica Kosanovic  
Tesla's sister

PAGE 218 New York, Dec 19, 1928

TO: MARICA KOSANOVIC PLASKI, LIKA CROATIA, OGULIN YUGOSLAVIA  
The best of greetings-Hug you Your Brother, Nikola  
PAGE 219

N. Tesla to N. Trbojevic  
Tesla's Nephew  
My Dear Nephew:

Hotel Pennsylvania, NY Dec. 22, 1928

I received both of your letters—one of 13th and one of 18th (this month)<sup>1</sup> and the final \$500 and now our accounts are in order.

I am surprised that you agree at the request of that manipulative lawyer when you could have borrowed from your bank money on the contract of GM as collateral and no losses. Watch yourself in the future; I had some kind of business with these kinds of people and got out in a sly manner to pay me nothing. You will get along much better with Timken. It is one of the 'most credible'<sup>2</sup> companies in America. The fault might be in the machine in a way. Please explain to me that whether that is true.

My firm is coming along and everything is on the edge of success and everything is in the production stage. It may be that I will receive some money soon—large amounts will not come until I produce some practical but large amounts, apparatus and patents. Wishing you the Best of Health, I remain, Your Uncle Nikola 1. unknown 2. insert.

PAGE 220

Olga Peruaca to N. Tesla  
Tesla's Cousin

Belgrade, Karadjordjeva St.  
Dec. 23, 1928

My Dear Brother! (cousin)

I wrote to you last year and I did not get a reply of any kind. I thought that maybe you did not get my letter knowing your good and noble heart toward your relatives. You were here 30 years ago in Gracac and you petted me and gave me a ducat.

I know through so many years one forgets relatives and friends. I am at liberty to tell you that you are my cousin who thinks of you many times as a Great Serbian Genius.

I am Olga Mandic, daughter of the late Trivun Mandic from Gracac. He is your uncle. I was born 1883 and married 1903 to Janko Peruac, a financial clerk.

We have three children, a son Milenko, student of electrical engineering; a daughter, Branka, student in the 8th grade and a daughter Nadezda, student in the 4th year high school.

The children thanks to merciful God are well and are good students. My son Milenko is very gifted and would like to work for you. PAGE 221

Things are very expensive here and my husband was pensioned for political reasons. He has a small pension and even with the strictest of savings we cannot make ends meet.

Even if it is difficult for me I probably borrow you who is very busy! I ask you as a cousin a little monetary favor if you can buy some clothes for the children and I thank you in advance prior to the coming Christmas Holidays & New Year. Hoping that God grant you many years of good



health & satisfaction to continue to benefit the Serbian people and your kinfolk. Accept many warm greetings, Your Cousin Olga.

PAGE 222  
LETTERHEAD TIMKEN-DETROIT AXLE CO.

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Jan 25, 1929

My Dear Uncle:

I am sending a check here for \$250 based on today's conversation. I am sorry that you were ill; watch out for your health because the evil influenza can return.

My ulcers are completely cured and now my stomach is in complete order and still have acid(imitation) and some kind of cramp or "spasm" in the duodenum. The doctor says that it will go away when the stomach heals.

As I told you, I am living in a small bachelor's hotel(men). However, I visit my wife & Jackie and I pay all the expenses. You will at your convenience will understand that I was absolutely forced to make that desperate step, because, my work and life was in danger due to my nervousness. What is one to do! Now I only work & sleep and read and already I<sup>1</sup> gained 4 lbs. this month.

Back home they write that all are well and think about you., Your Niko

PAGE 223  
N. Tesla to N. Trbojevic TIMKEN DETROIT AXLE CO.  
Tesla's Nephew

Detroit, MI  
Jan 28, 1929

My Dear<sup>1</sup> Nephew:

I received your letter of the 25th this month with a check for \$250. I thank you very much. As soon as I get a check that I am anticipating, I shall return the loan<sup>2</sup>

I am very sorry that your domestic matters are so unsettled. That is a serious and dangerous situation because women have much power in America. Look at your wife if she falls in with an unscrupulous lawyer's hands who will fleece you and cheat her. The best would be to that somehow you solve this problem. I am afraid that with my best intention when I wrote to her under that pressure<sup>3</sup>

Discuss with her your problems when your health is restored. You don't write anything about your work. Did you achieve your work goals?

My friends in Philadelphia are progressing very well. According to my thinking, we might need a rear axle drive.

I Greet you warmly, Your Uncle Nikola. 1.inserted 2. quota 3. inserted 4. in place of  
page 224

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
March 6, 1929

My Dear Uncle:

I have been talking a long time about my difficulties, as you well know. However things are much better. My wife probably likes me because she does not want a divorce. I am still staying at the hotel(because of much work and my health) and Sundays I am home and then I go with her and Jackie to the theater or for an automobile ride.

My work is going well now and only yesterday the first time produced an accurate gear for the rear axle at Timken. This gear now runs very well on the block, and now we shall make in 2 or 3 days 3 axles and put them on the dynamometer. I believe that it has 97% efficiency, because I have 400% more oil pumping action than heretofore. If this succeeds, this is an idea for new type of bearings that will compete with ball and roller bearings.

How are You? How is Your Health? Please Write. Niko



Dear Leland

10-4-95

Hope that this will  
do it. Please let me  
know if anything else  
I can do in this matter

We do have, as you  
know, this book too.

Sincerely  
Nikola

5 уместуто  
6 уместуто  
7 прецртано  
8 уместо прецртаног египту  
9 уместуто  
10 уместуто  
11 уместо прецртаног брда  
12 уместо прецртаног ваграна

пошаљем  
са пример-  
их остајем



Прота Томо Будисављевић, прадеда Николе Тесле, по мајин

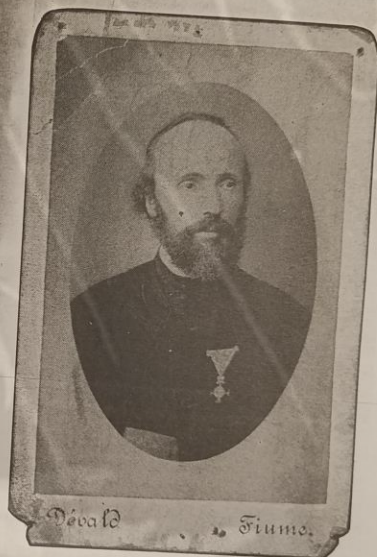
V.K.M. Tomo Budisavljevic, grandfather of N.T. on  
his mother side.





Смилян — Место рођења Н. Тесле

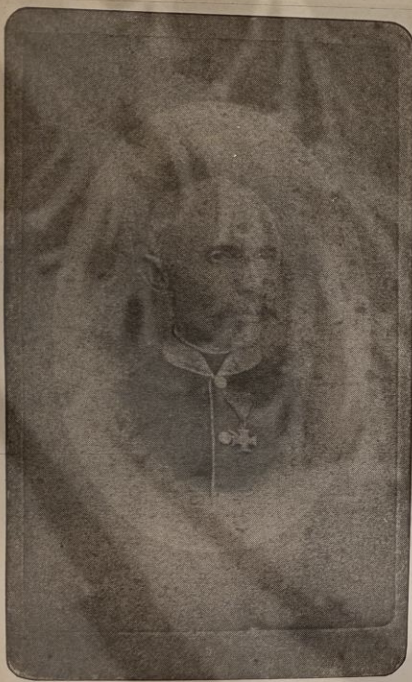
Смилян, родна кућа Николе Тесле  
Smiljan, house of N.T. birth.



Devald ..... Trimo.

Милутин Тесла, отац Николе Тесле  
MILUTIN TESLA, father of N.T.



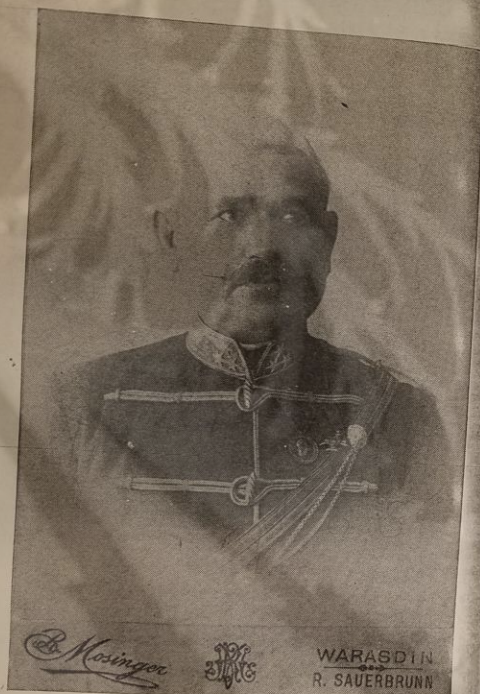


Јосиф Тесла, стриц Николе Тесле  
JOSEF TESLA, FIRST COUSIN  
(BROTHER OF HIS FATHER)



Петар Мандић, ујак Николе Тесле  
У монаштву је примио име Николај  
PETAR MANDIC, UNCLE (MOTHER'S BROTHER)





*Ed. Mosinger*



WARASDIN  
R. SAUERBRUNN

Пајо Мандић, ујак Николе Тесле  
PAJO MANDIC, uncle of N.T.



This picture was sent to him by his sister  
Marica Kosanovic.

Кућа у Госпићу где је Никола Тесла са породицом живео од 1863 г.  
На поштом фотографије, сестра Марица Косановић, која је Тесли  
послала фотографију у Америку, је написала:  
"Што ћеш моја у приморју куло  
кад по теби нико штет" нема  
Нар. пјесма"

House in Gospić, where N.T. & his family lived  
in 1863 and after. He received this photo while in USA





PHOT. BLANC  
11, Rue de Buci



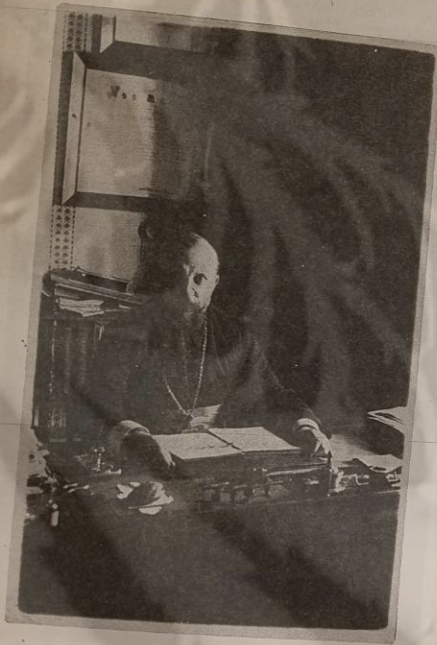
HENRI DUPONT  
Boulevard

Никола Тесла из времена боравка у Паризу 1882-1884 г.  
*N.T. while in Paris -*



Ангелина Трбојевић, сестра Николе Тесле  
*Angelina Trbojevic, sister of N.T.*



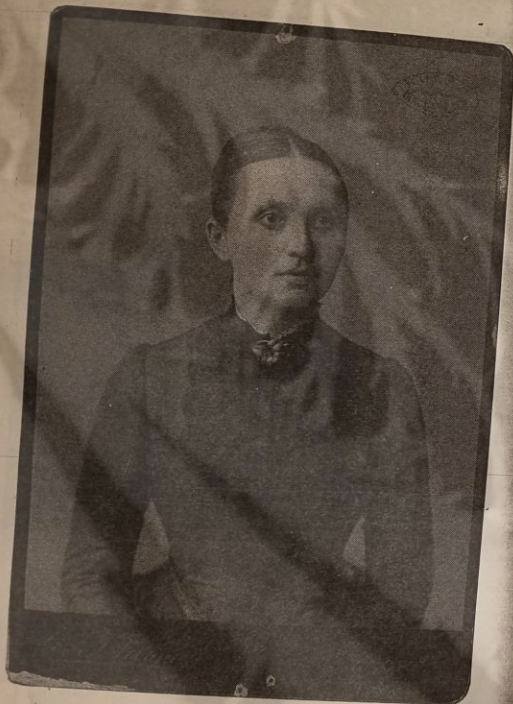


Петроније Трбојевић, син Ангелине и Јове Трбојевића  
*PETRONIJE TRBOJEVIĆ, son of Angelina  
(his sister) and Jovo Trbojević*

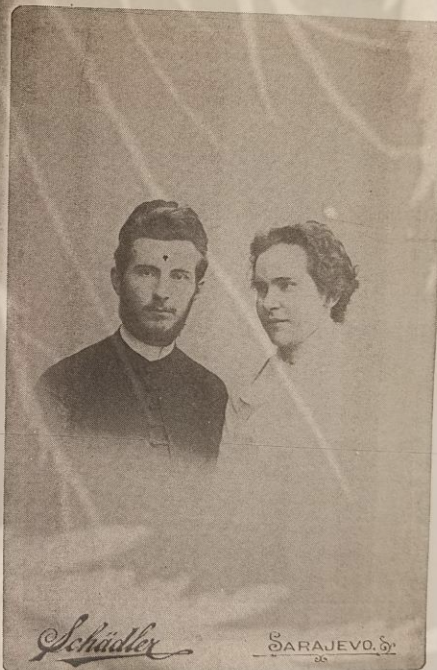


Никола Трбојевић, син Ангелине и Јове Трбојевића  
*NIKOLA TRBOJEVIĆ, son of Angelina & Jovo T.*





Милка Глумић, сестра Николе Тесле  
MILKA GLUMIĆ, sister of N.T.

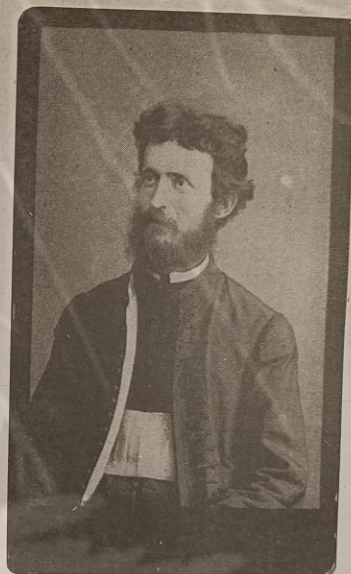


Гина Глумић, ћерка Милке и Вуја Глумића, са мужем Петром  
Лалићем  
GINA GLUMIĆ, daughter of MILKA & VUJA  
GLUMIĆ, with her husband PETER LALIĆ



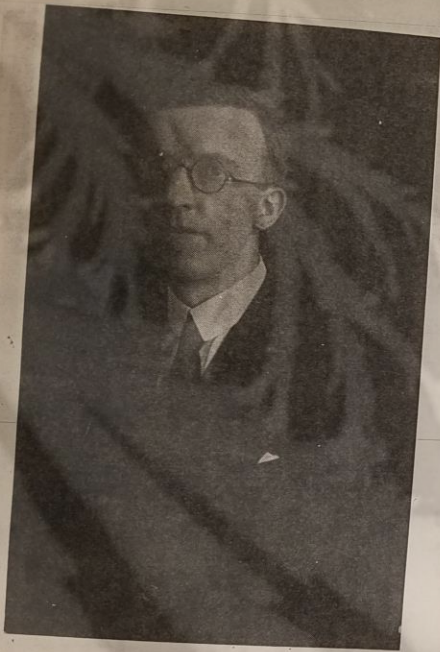


Марича Косановић, Теслина сестра.  
На полеђини фотографије стоји: "Октобра 890. Марича"  
MARICA KOSANOVIC, TESLA'S Sister.  
On the back of this photo is date: Oct. '890



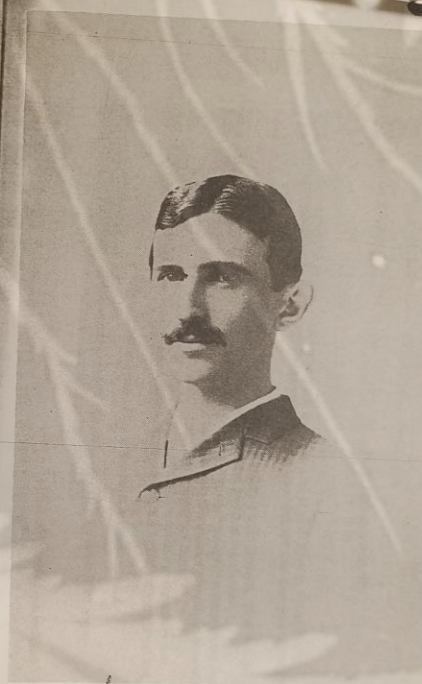
Николадин Косановић, муж Мариче Косановић.  
На полеђини фотографије стоји: "Ник. Косановић, 1889"  
NIKOLADIN KOSANOVIC, husband of MARICA.  
On back side is date: NIK. K., 1889.





Сава Косановић, син Марице и Николадића Косановића.  
На полеђини фотографије, Марица Косановић је исписала:  
"Ово је мој син Саво (Брацо), да не би мислио, да ко  
покушава мистифицирати."

SAVA KOSANOVIC, son of MARICA KOSANOVIC.  
NIKOLADIN. On its back she wrote: "This is my  
son SAVA (BRACA) so that nobody could make no mistake"



Никола Тесла по доласку у Америку (након 1884 г.)

N.T. upon his arrival in USA  
(1884)



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 225

N. Tesla to N. Trbojevic  
Tesla's Nephew

Hotel Pennsylvania, NY  
March 14, 1929

My Dear Nephew:

I wasn't able to answer your last letter immediately, because a lot of work here in Philadelphia. I was very pleased that you work with Timken which has a good outlook and that your domestic situation is improving.

I can't<sup>1</sup> understand why that a greater amount of oil circulation is so important. That can be easily achieved. The main thing is that it is realized<sup>2</sup> precision and that the surface is in contact which increases whatever it can be<sup>3</sup>. There is always some minority<sup>4</sup> oil that gives the best results. In my turbines when the speed is more than 150 RPM<sup>5</sup> it cannot be utilized much<sup>6</sup>. At a higher level the bearings fractionate and break down and sometimes burn.

I would like to know how are your attempts with GM turn out? It seems to me somehow that you will be more successful with Timken because these are people of a higher caliber<sup>8</sup> than the others.

Your wife would love you if she understood you. Stay at the hotel because distance strengthens the desire.

In some way it is well for me and again it couldn't be worse and until I extract from some source a lot of money. I waited for that machinery-all will be well<sup>9</sup>.

PAGE 226

What it means I had an awful situation. My heart aches that I didn't<sup>10</sup> send to our kinfolk some money-they are suffering<sup>11</sup> must have happened unnecessarily<sup>12</sup>. Greetings to you. Wishing you the best of success. I remain Your Uncle Nikola

PAGE 227

Nikola Tesla to N. Trbojevic  
Tesla's Nephew

Hotel Pennsylvania, NY  
March 27, 1929

My Dear Nephew:

I could not figure out from your yesterday's letter that this surface  $8 \times 5/2$  times greater in your unit than in a normal worm gear along construction lines or only because of this that it is peripheral velocity<sup>1</sup> so much<sup>2</sup> greater? In the first case the result will be however better because there is a specific pressure only  $2/8 \times 5$  from the normal under same weight. In a similar way than what will be achieved in another case if peripheral isn't too large.

Your theory is rational but it must be expressed differently. It is direct<sup>3</sup> cause of improving the speed but a consequence from the same<sup>4</sup> you can verify this with simple calculation according to the law  $mv = ft$  (Newton-Ed note)

When the skin is thin<sup>5</sup> from oil breaks & forces the worm gear in metallic<sup>6</sup> contact with the wheel with a very high speed according to that which penetrates is unknown and besides this skin becomes so to speak unbelievably thin before it breaks. But your idea is in common with experimental results as speed is increased  $10^7$  with the moment of necessary pressure under which the skin breaks. Which is:  $P = c(V)^{1/2}$  pounds ( $C = 8.25$ ). Your first pressure will be  $(8 \times 5)^{1/2} / 2 = (4 \times 25)^{1/2} / 2300 / 400 = 2.06$  times greater than usual and the skin will hold up longer.

PAGE 228

Yhay is why in all of these situations oiling is necessary, otherwise the components will burn up, or wear out little by little. For them to last the longest one must 1) large surface i.e.  $1^8$ ... small<sup>9</sup> specific pressure; 2) High speed 3) precision  $\times 4$  worm gear of hardest metal.





163.

Никола Трбојевић - Николи Тесли  
Детроит, 23. априла 1929.

(Заглавље: The Timken - Detroit Axle Co....)

Сриједа, Apr 23. 1929.

Мили мој Ујаче: -

Ево Вам шаљем спецификацију од Timken Cam Gear а исти gear је и за G.M. steering gear.

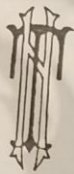
Хвала Вам на интересовању, и сад ћу Вам рећи о потешкоћама са овим "worm gear".

We have a ratio 26 into 6,  $5 \frac{1}{4}$ " centers,  $33^\circ$  helix angle. The worm is bronze, the gear steel, hardened ground. Length of worm  $4 \frac{1}{2}$ ", length of helixal tooth in the worm  $8 \frac{1}{2}$ "

We are getting a "bearing" in the worm through the entire length of its threads,  $8 \frac{1}{2}$  inches in each of the 6 thds. The gear tooth has a short bearing, about 1". The errors in spacing of gear teeth are max. 0,0045" for which reason the drive is noisy at high speeds (2000 R.P.M) and has not simultaneous contact with 4 teeth at once which would be the case if the gear teeth were evenly spaced. Now I am trying to reground the gears in another machine and hope to bring the spacing errors down to 0005 which I think would be close enough.

In action, the steel gear tooth enters the hour glass worm at one end, and rides over it as if over a cam through the said distance of  $8 \frac{1}{2}$  inches. Comparing this with the conventional worm drive (in which the gear is made of bronze), the length of bronze tooth is only 2" for the same centers and ratio. So you see that I ride over bronze 4 inches faster then formerly, which ought to give me a better efficiency as





I uncover 4 times as great an oil film areas per second. At the same time  $\sqrt{we}^1$  have an overlap of 4 teeth whereas the present gear has only 1.5 overlap. The cost of manufacture is approximately the same as formerly, perhaps even less on acc't of less bronze being used. At  $33^\circ$  helix angle the drive "coasts" very freely from which I hope that the efficiency is rather high.

Regarding the surfaces that contact, the gear \tooth\ <sup>2</sup> is convex everywhere, the worm tooth is partly convex, and partly concave (in the mid portion). This may cause some trouble as convex pressing upon convex will smesh the bronze. The wear is very favourable as the gears tend to wear themselves always in a more and more accurate profile, so far as I could see it. The gear being hard steel does not wear at all, and if I had an accurate gear to start with, everything would be easy.

Пишите ми о Вашим стварима. Кад би могли или Ви или ја убрзо успијети, све би било фино за нас обадва. Али вријеме, вријеме страшно брзо пролази.

Грли вас Ваш вијерни  
Нико

1 уметнуто  
2 уметнуто

Превод

Сриједа Април 23. 1929

Ево Вам шаљем спецификацију од Timken Can Gear а исти зупчаник је за G.M. пужасте преносник.

Хвала Вам на интересовању, и сад ћу Вам рећи о потешкоћама са мојим пужастим преносником.



165.

Никола Тесла - Николи Трбојевићу  
Њујорк, 15. маја 1929.

Hotel Pennsylvania N.Y.  
May 15, 1929.

My dear nephew,

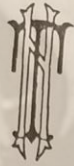
Under inclosure I am returning your specification descriptive of the [hour-glass] work with some suggestions relative to the same.

You are very deep, indeed, in the gear science and must have burned a lot of midnight oil / to /<sup>1</sup> evolve such a device. It is evidently a very valuable invention and there is no doubt in my mind that you will secure broad claims.

The greatest advantage of your work is the relatively very small specific pressure  $\left( \frac{\text{Total gear pressure lbs.}}{\text{Area of actual contact sq. inchs}} \right)$  It has a beneficial effect on lubrication and efficiency and wich greatly reduce wear which diminister with the pressure according to an exponential function. You do not get a greater speed but only uncover a /larger/<sup>2</sup> oilfilm surface per second. The speed of the worm is the same as that of the wheel / since /<sup>3</sup> / es /<sup>4</sup> there is no slip. Nevertheless you will improve the lubrication /through the reduction of pressure/<sup>5</sup>. The force of adhesion is / so/<sup>6</sup> great /enough/<sup>7</sup> /as/<sup>8</sup> to carry the oil into the pressure area at the smallest velocities but, according to my theory, the lubricant can only penetrate up to an isobaric contact line at which the pressure  $p = cuv$ . As the coefficient  $c$  is usually not much greater then 8 it is clear that when driving the worm with /a/<sup>9</sup> low speed in /engine/<sup>10</sup> the lubricant is cut off not far from its entrance into the pressure area so that for a considerable portion of a revolution the gear runs dry. In turbine operated worms the conditions are incomparably better.

Your method of generating the teeth has /much/<sup>11</sup> impressed me. /very much/<sup>12</sup> Irrespective of its practical value it is a notable contribution to theoretical science. You have an almost uncanny. knowledge in this field. The modification you have indicated with two worms may be useful in driving /the/<sup>13</sup> twin screws of ships.





The spurgears, I understand, have no work to perform other then keeping the worms in step.

I hope that you will soon attain perfection in the manufacture of this worm drive which is [ideally skilled] for trucks and automobiles. In my opinion you will reach quicker results by making the work of Nitrogen hardened steel instead of bronze. You must remember that the life of a gear is limited to  $\frac{1}{14}$  of its smaller member and bronze is advantageous only when  $\frac{1}{15}$  in  $\frac{1}{16}$  sliding contacts.

With best wishes for success I remain

Your devoted uncle  
N Tesla

Nikola Trbojevich Esq.  
The Timken Detroit Axle Co.  
Clerk Avenue  
Detroit, Mich.

- 1 уместо прецртаног нечитко написаног слова
- 2 написано преко greater
- 3 уметнуто
- 4 прецртано
- 5 уметнуто
- 6 прецртано
- 7 уметнуто
- 8 прецртано
- 9 уметнуто
- 10 исправљено из engines
- 11 уметнуто
- 12 прецртано
- 13 уметнуто
- 14 уместо прецртаног the life
- 15 прецртано
- 16 уметнуто



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 228 CONT'D

to express the idea of your improvement<sup>10</sup> in English 1) Your resort to high relative speed in order that the pressure necessary to break the oil film may be greater and that thereby this is better enabled to penetrate further and get closer to the locus of maximum pressure or dry contact. 2) You employ a constructively larger contact surface to reduce the specific pressure and to do so still further enhances the first effect.

Your theory is correct and entirely dependable. If you do not get better results than with ordinary forms of worm gear, then it must be due to some trivial cause; most likely a lack of precision in cutting and mounting the gear or use of poor metal.

Your Uncle, Nikola

1) inserted; 2) same as i; 3) in place or redrawn; 4) same as 4; 5) redrawn; 6) in place of; 7) inserted; 8) redrawn; 9) corrected from small; 10) in place of

PAGE 229

letterhead IN ENGLISH

PAGE 230 IN ENGLISH

PAGE 231 IS TRANSLATION OF ENGLISH 230

PAGE 232

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
MAY 6, 1929

Dear Uncle:

Here I am giving you good news that GM again returned to my "steering gear" and we have renewed the experiments. Now we will completely abandon "bronze" and will build a worm gear of steel. I corrected the design now and hope this path will go further.

The method of cutting spur gears for transmissions by means of "solid worm" types of clearance hobs also is progressing satisfactorily and I have no good reason to believe that this job will go over big; as we already have<sup>1</sup> cut some gears in which the involute was to within .0015" and that is just the beginning.

How are you? I am afraid that things are not going well with you since you don't write. Please call, Your Niko 1) inserted.

PAGE 233

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
April 23, 1929

My Dear Uncle

Here I am sending the specifications of the Timken Cam Gear and the same gear is for GM steering Gear.

Thank you for your interest; and now I shall tell you of the difficulties with the "worm gear".

We have a ratio of 26 into 6, 5 1/4" centers, 33°. The worm is bronze, the gear is steel, hardened and ground. Length of worm is 4 1/2", length of helical tooth in the worm is 8 1/2".

We are getting a "bearing" in the worm through the entire length of its threads, 8 1/2" in each of the 6 threads. The gear tooth has a short bearing; about 1" The errors in spacing of gear teeth are maximum .0045" for which reason the drive at once which would be the case if the gear teeth were evenly spaced. Now, I am trying to regrind the gears in another machine and hope to bring the spacing errors down to .0005" which I think would be close enough.

In action, the steel gear tooth enters the hour glass worm at one end, and rides over it as if over a cam through the said distance of 8 1/2". Comparing this with the conventional worm drive (in which the gear is made of bronze), the length of bronze tooth is only 2" for the same centers and ratio. So you see that I ride over bronze 4" faster than formerly, which ought to give me a better efficiency as

PAGE 234 is in ENGLISH

<sup>5</sup>  
<sup>6</sup>  
PAGE 234 & 235 IS TRANSLATION OF PAGE 233

1) redrawn; 2) inserted; 3) inserted; 4) redrawn; 5) inserted; 6) redrawn; 7) inserted; 8) redrawn; 9) inserted 10) incorrect engines 11) inserted 12) redrawn 13) inserted; 14) insert-life; 15) redrawn 16) inserted



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 237  
N. Tesla to N. Trbojevic  
Tesla's Nephew

Hoel Pennsylvania, NY Tesla's  
May 16, 1929

My Dear Nephew:

I hope that you received your specifications that I sent with my recommendations. One must complete as much as possible because your patent is based on your<sup>1</sup> important<sup>2</sup> company where you began this work.

You did not have to be /a genius/<sup>3</sup> to guess how it is with me. It isn't bad but terrible. As I told you before I developed a wonderful invention a/new/<sup>4</sup> by which<sup>5</sup> [...] in a completely simple way will be able to produce rays so called unlimited power. /You/<sup>6</sup> /can/<sup>7</sup> use for producing all kinds of unbelievable effects in peace and war /and that is at the greatest distances/<sup>8</sup>. I turned to my best friend in Paris to telegraph & send \$5,000 and he hoped he would.. I did not know that he was /very/<sup>11</sup> ill for a year and then word came back that he died from cancer. ?I was present/<sup>12</sup> at his burial in Washington and still feel an emptiness/<sup>13</sup> in my heart, because, we were like brothers for 38 years. He would have given me \$100,000 if it would be very difficult to pay back.

Now, these things happened/<sup>14</sup> in novels one reads. because of other people I had business with in 1914 one of my managers messed up my bank account and it is frozen until litigation is complete.

/Again/<sup>15</sup> something worse; I loaned last year/<sup>16</sup> from a bank in Philadelphia \$15,000 based on my contract with Waltham Watch Co. Not long ago the Federal Reserve announced an edict that crippled the bank and I had to pay my loan /immediately/<sup>17</sup> through some friends/who/<sup>18</sup> now are now in serious monetary difficulties<sup>19</sup>. Meanwhile the company Waltham wants to buy my patent and I promised to reduce the royalty by 1/3 if they pay me \$75,000/<sup>20</sup>. That seemed a lot to them and the letter predicted that I will be without the money and what is worse, I am afraid that I /still/<sup>22</sup> some few hundred which /cleans up/<sup>23</sup> and send through until I settle this even with large losses.

Warmest Greeting, Your Uncle, Nikola  
1) inserted 2) not made up 3) incorrect, redrawn 4) inserted 5) instead redrawn 6) redrawn 7) redrawn 8) inserted 9) inserted 10) inserted 11) instead of 12) inserted 13) redrawn 14) inserted 15) instead, redrawn 16) inserted 17) redrawn 18) instead redrawn 19) instead, redrawn 20) inserted 21) redrawn 22) inserted 23) redrawn PAGE 238  
N. Trbojevic to N. Tesla  
Tesla's Nephew

LETTERHEAD TIMKEN DETROIT AXLE

Detroit, MI  
May 18, 1929

My Dear Uncle:

I received your specifications yesterday with your remarks and today here is your letter. You have spent a lot of time and work and than you very much.

My work is still going along but I hope better. I am sorry that you have such unexpected monetary problems. I am also in the same situation, all of my money I loaned to friends; now I cannot even get the interest and let alone the principal! If I succeed now with anything or a check from GM, I shall help you again. Now I am working on three large projects and am completely exhausted and they are 1) steering gear for GM; 2) clearance less hob for GM 3) rear axles, single and double cam gear drive for Timken. I am about to go nuts.

Why don't you try Washington with your new rays? How is your steel? Aeroplane? Speed indicator?

I read about your notes and remarks. You are truly a master for patents. You would be able to give lectures to those so-called patent attorneys.

I am well and will write as soon as I have time  
Your Niko



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 240

N. Tesla to N. Trbojevic  
Tesla's Nephew

Hotel Pennsylvania  
May 19, 1929

My /Dear/<sup>1</sup>Nephew:

Now I received the sad/<sup>2</sup> news that you are also in dire straits. Think about what is /going/<sup>3</sup> on with Tesla when Trbojevic is in a bad situation.

When you get a reply from the examiner, reprint the specifications with my remarks and it would be fine if I could review the amendment before you send it to Washington. It would be a shame if the patent was issued full of mistakes.

To reply /in short/<sup>4</sup> I do not have enough money to complete the speedometer, because, I had to stop work many times that/<sup>5</sup>

With respect to those other [...] metals the engineers want that I put everything in writing to them before there is a contract signed. I did not want to do that because I was sure that so many technicians with whom I had cultivated friendly relations break up.

I showed my aeroplane (vertical takeoff) to GM and they asked that I send the plans which I have the rights to /this/<sup>6</sup> I can refuse. I have very good patents of the aeroplane but I need 2 more patents/<sup>7</sup> to secure an automobile that will be like a normal car that can fly in the air when /for/<sup>10</sup> needs. They don't want to/<sup>11</sup> accept the aeroplane because/<sup>12</sup> they say it is not their discipline and apparatus for high energy. If I did something like this it would be found out and and my goose would be cooked.

I thought much about everything and I saw that the best solution to my problems is with the Waltham Watch Co.. I /can/ get enough money from Waltham Watch to pay off \$20,000 and could keep as much. My greatest difficulty now is money. I would get out of a hole. Greetings.

Nikola. 1) inserted 2) to 19 in book PAGE 241

P. S. I received more complements from the Patent Office that from you.

PAGE 242

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
June 7, 1929

My Dear Uncle:

I received your kind letter of last week and I am sorry that you are in such a bad situation. My work is going much better-steering gears are doing fine and this time I think I will succeed. This time I employed 16 teeth in the gear and 17 teeth (one more) in the cutter to cut the marking wormgear and make suitable corrections in the head of a helixed base diameter, etc. The extra tooth serves to absorb my manufacturing error and it serves fine. Now I can take my gears just as they come from the machine and put them together without any lapping, scraping, etc and they fit together and run smoothly.

You are surprised that the new Tesla /and/ Trbojevic people are in financial difficulties but the difference is that Tesla is in dire straits because he spent the money but also loaned to friends..

Now I am working on clearance cutter for steering gears. If this succeeds I will be able to change my contract with GM. How things stand today, they have an option for the steering gear for \$100,000 /cash/ non exclusive and \$200,000 exclusive. I would rather change this to straight royalty without options, because, royalties yield \$150,000 yearly. We shall see. My patent applications on the clearance cutter are very strong and indisputable, while, the steering gear is somewhat more vulnerable.

I will write again shortly and tell you how things are going and hope all will be well



PAGE 243

How you write-your speedometer I think would be Starret. That is a very big harm . You had an easy toget money fast. Greetings, Niko



TESLA'S CORRESPONDENCE WITH RELATIVES PAGE 244

N. Tesla to N. Trbojevic

Tesla's Nephew

Hotel Pennsylvania, NY

July 10, 1929

/My/! Dear Nephew:

I was very please to know from your letter of the 7th of this month that you are succeeding in your work. I am sorry that you are like the whole world- angry at me.. You are lookin for as Diogenes with a lamp in the afternoon that you might find a man who creates imaginary thoughts with less expense than your misunderstood uncle. This was a real mania for me since I began working relentlessly. For the last 40 years I never made any attempt that I had not discovered or completed as is the custom. I always complete everything in my head to the smallest detail and all goes well without changes as planned. You are correct that I spent the money because you did not see the difference between Tesla and Trbojevic. Tesla loaned all over large sums and did not get the money back at all; while Trbojevic saved like his dad and every dollar will come back with interest except those that you loan to the church which is like last year's snow Die Kirche(Church) guten magen).

You did no understand the situation with GM. They don't pay at all/royalty or buy a non-exclusive license; that is why you saved at least a million dollars in fact without overtures. It is easy to get if th gear is O.K. But noto bene-they will not pay you not a cent if your specifications aren't better than those that you sent me a short while ago. I was very busy and did do everything to satisfy myself according to your conditions you will get a patent of great value. I do not know what is the clearanceless cutter and would like to read/of this invention.

PAGE 245

As I wrote you before I am afraid that you will not succeed with the first of bronze, because, will wear away fast. It would be best liquid nitrogen hardened. This is a relatively new cold process which does not cause distortion and dispenses with the necessity of satrigent finish.

Not long ago I broke a rib\near\^near the heart and for 10 days I was in dreadful pain. Luckily the rib did not hit the kidneys. I will be completely cured shortly.

You don't write about matters back home and that is a good omen.

Wish you the Best, Yout Uncle Nikola

1) inserted 2)inserted 3) written over specifications 4)written over.

PAGE 246

N. Trbojevic to N. Tesla

Tesla's Nephew

TIMKEN LETTERHEAD

Detroit, MI

July 13, 1929

My Dear Uncle:

I haven't written in a long time due to a lot of work. My steering gear for GM looks like it has passed the tests, becuase, they have decided to go into production, beginning October 1 of this year. Now we have completed models for Marquette, Olds, Oakland and Pontiac and now we are working on Cadillac and LaSalle. I have hope that this will succeed and I will make some money.

I completed a while ago at Timkenthree basic units for Stutz and this week will be a test for a dynamometer. They already tried to break an acle but could not brek it. This is a good omen.

How are you? Did the pain in your ribs go away? About the old country, we write regularly and ask about you always especially my mother, Your Nephew, Niko

known with March 1929 (translating) - 1 unit



N. Tesla to N. Trbojevic  
Tesla's Nephew

POSTAL TELEGRAPH

New York  
October 4, 1929

Nikola Trbojevic Detroit Timken Axle Co.  
Opponents want to get my stocks, Now I am positive that they cannot succeed. That amount has  
to be paid. Uncle

PAGE 248

N. Trbojevic to N. Tesla  
Tesla's Nephew  
Dear Uncle:

Detroit, MI  
Oct. 4, 1929

I am sorry that they cannot help you for now and I am also in a bad situation. I did not even  
get any money from GM, and if these Timken axles do not succeed, I can even lose this job.  
Besides that my wife is ill and a baby is coming in April (Wm. H. Terbo -ed note) I am myself to  
blame for all of this because I had enough money for myself, but. O ;paned out all over the place  
and cannot get anything back. Here is \$100/Your Nephew, Niko

PAGE 249

Sofija Alagic  
Tesla's Cousin

Celje, Slovenia  
1929

My Only Brother( Cousins are called brother);<sup>1</sup>

I think & hope that you truly call you my brother, because, you dear and deceased mother with  
you and your dear sister on her lap and with her motherly kindness raised me from one year of  
age since I lost my mother.

After we went in different directions throughout the world and the older ones in our family  
passed away only you, Angelina, Marica, your sister, I and Milka, Uncle Tomo are still alive, but  
we are so far apart that even in despair or difficulty we cannot help each other.

Dear brother prior to the war everyone lived pretty well for himself, but, now after the war,  
some died and some were killed and some left home and everything is turned around and the  
war debilitated all and one cannot live with conditions here.

My youngest daughter was married to a priest (Orthodox) in Slovenia and three years ago she  
got tuberculosis and passed away and she, poor lady was left with 5 small children in a strange  
land. That is how I come to her possibly help her with my small dowry. Up to now things were  
OK but this year I became ill in August and was in bed two months and the doctor and medicine  
are expensive and I ran into debt and was weakened and on does not know where to turn. I  
would like to return to our country (Lika) but I have no funds. Three children are in high school  
and two in the elementary school and I took the liberty to ask for help so that I can pay some  
debts and move to our land where there are schools while I am still alive because

PAGE 250

my daughter would not be able to go anywhere and it would be a shame. The children all are  
honor students.. I have aged 73 years of age and cannot help much. Dear Nikola I beg you not to  
let me down and give me at least some little support and that we can leave this strange land and  
have funds to go back home. We are in Celje between Maribor and Ljubljana.. Believe me that  
I agonized a long time before I made this step to write to you. With the Serbian custom of  
sisterly love. Your Sister Sofija Alagic

accept from the daughter and children a kiss of your hand  
my address: Udova profesora bogoslovije, Celje, Slovenia Vrvarska Ulica.



Tesla's Correspondence with Relatives PAGE 251  
N. Tesla to N. Trbojevic  
Tesla's Nephew

Hotel Pennsylvania, NY  
October 4, 1929

Dear Nephew: I had some trivial matters and so many to take care of that I could not write until today. I am still struggling with my money problems.

I am sorry to hear that your immediate situation is getting worse. With respect to GM I had predicted to you four months ago. I said that they would not pay you anything for that patent as it was written. Too bad that you did not inform me sooner about it. I still not finished that work on metals so that this time I am not going into debt for a large sum that is needed to begin the project. I hope the best., Your Uncle Nikola

N. Trbojevic to N. Tesla  
Tesla's Nephew

PAGE 252

Detroit, MI  
Nov. 18, 1929

Dear Uncle:

I received your letter of Nov., 12 with an article by you in "World magazine". My God, you [...] Edison; too bad this will not help you much in your work because Edison became an American institution or symbol, like the American flag and whoever criticizes Edison, he runs into a hornets nest of opposition from every American. It is a thankless job to criticize Edison in America..

I would like to cleanup that debt you owe me of \$700 that I gave you as my share immediately<sup>1</sup>. Send me a IOU note so that I have an acknowledgement from you. About the \$2,500 that I gave you last year and tell me truthfully and honestly 1) Do you have a contract with Starret Tool Co? 2) Do you have a patent? 3) Do you have production? 4) Do these people know I have a 20% interest?

All my things are going slow and that is the reason I ask if you can put them in order or not. You can pay me when you are in better straits. If it is in order send me a copy of the contract and patent. If you don't have either, then, send a note for \$2,500 plus 6% interest. Back home everything is fine. Mother asks about you and greets you, Your Nephew, Niko.

PAGE 253

N. Tesla to N. Trbojevic  
Tesla's Nephew

Hotel Pennsylvania, NY  
Nov. 20, 1929

I received your letter of the 18th and I gathered that things are bad with you. Do not become pessimistic, things will surely turn around.

You are wrong about Edison as an American institution. All of the propaganda does not worth one iota. My article had a big impression and you are correct it does not help me.

I think that<sup>1</sup> you are not normal because that you demand that honestly and openly ask how are things with Starret Tool Co.<sup>2</sup> I had expressed so much about this that I don't know what else to say [...] preliminary agreement with them and then they were very eager as of now to fabricate my old model and I did not want to agree to this because I found out later<sup>3</sup> some things are better and cheaper and this new model would have been made quite a while ago and would have received the money right away. However the work would have been done<sup>4</sup> in their factory and I watch that because I have already been burned before<sup>5</sup> in their factory like you with GM Co. About patents, I did not do anything neither can I<sup>7</sup> until I complete all<sup>6</sup> because<sup>8</sup> that is my big donkey when they mention anything prior to contract signing. About the production one cannot mention.

In these circumstances I will be<sup>12</sup> best that I give you an IOU for \$2,500 and same for that \$700 check which you will find in due time.

1929 Nov 20 N. Tesla to N. Trbojevic (1929 Nov 20)



Tesla's Correspondence with Relatives PAGE 254 CONT'D LETTER  
2

as soon as I get the money, I will complete what I began. Starret has written me twice already about the situation and I had to promise <sup>15</sup> not to make arrangements with other companies. I left the date open, but, I believe extending the time might help-how is July 1, 1930. Hope that things are better for you and for me. Your Honest Uncle, Nikola

PAGE 255

### WESTERN UNION CABLEGRAM

Received at

Nikola Tesla Hotel Pennsylvania New York City: Plaski, Lika, Dec. 18, 1929

From all of us we congratulate you on your name day. Marica  
(translator's note-Dec. 19th is St. Nicholas Day.)

PAGE 256

N. Trbojevic to N. Tesla  
Tesla's Nephew

LETTRHEAD TIMKEN

Detroit, MI  
Feb. 27, 1930

Dear Uncle:

I have not heard from you already for 3 months and I wonder how are you. My work is very difficult and things are not going well, but with luck I will hold my job at Timken. My wife is going to have a baby in 2 or 3 weeks. (n.b. William H. Terbo)  
If it is not difficult for you, can you send some amount of your debt? I am in a difficult position because of these worries, expenses, etc. And I ask you to pay whatever you can.  
Greetings from Your Niko

PAGE 257

N. Trbojevic to N. Tesla  
Tesla's Nephew

LETTERHEAD TIMKEN

Detroit, MI  
April 22, 1930

Dear Uncle:

You did not answer my last letter and I am so sorry for you. My wife gave birth to a son who is healthy and beautiful. 10lbs 10oz and his name is Pavle (Paul). She wanted to name him William (after her father) and I did not allow it, because we did not ever have a William in our family.  
My work is so so and I have a problem for money. GM is making 1,000 of my steering gears daily (for 3 cars) and I do not get money from this as yet. I now have 5 patent pendings for the steering gear, first two were "allowed", and I hope this summer all will be. than possibly I shall receive some money from GM! I now began 12 experiments pieces for Ford Model A. I will tell you if I succeed. This gear will give a 30% longer swing (55° vs 41°) and will be 500% stronger than the present steering gear. I am still at Timken and don't know how long.  
Many Greetings, Your Niko

P.S. How are you? Did you make any progress with your steel, etc.?

I just now heard that my "steering gear" was accepted as a standard for the 16 cylinder Cadillac car

PAGE 258.

### WESTERN UNION CABLEGRAM

FROM: Marica Kosanovic Fiume, Italy

May 5, 1930

Nikola Tesla Hotel Pennsylvania, New York City. Congratulate you on St. George's Day from sister, Marica



Tesla's Correspondence with Relatives PAGE 259

**RADIOGRAM**

Marica Kosanovic to N. Tesla  
Tesla's sister

Plaski, Lika Croatia  
Dec. 18, 1930

received at 264 Fifth Ave, New York, NY  
We are happy with your progress and greet you on your name day.  
Marica Kosanovic

Fanika Tesla to N. Tesla  
Tesla's Cousin

PAGE 260

Ruma, Serbia  
June 9, 1931

Dear Cousin:

Seeing that you are in good stead and in comfortable circumstances to my relative, a great man and namesake I greet you.

I am the daughter of your late cousin Milutin Tesla and son of Josip Tesla, captain, your father's brother and Marija Tesla nee Mandic.

My father Milutin was a railroad representative in Ruma and married and died in 1914.

He left three daughters, of which two married and the youngest remained with mother. I am a representative at the royal circuit court in Ruma. I try to hold my own with my small salary to support my mother and myself.

How would be very happy that my letter reaches you and understand my plight.

Be true and it comforts me to take this opportunity to congratulate you and honored with the name of Tesla.

Your Neice, Fanika Tesla

PAGE 261

**WESTERN UNION TELEGRAM**

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
July 17, 1931

Governor Clinton Hotel

Your sister Angelina passed away day before yesterday.

PAGE 262

Uros Trbojevic to N. Tesla  
Tesla's Nephew

Zagreb, Croatia

STAMPED Dr. Uros Trbojevic, Attorney, boskovicova 3 II

Dear Uncle:

I am sending you a picture of my dear mother and your sister Angelina. This is her last photograph.

My late mother liked you right up to the end with unusual sisterly love. It was a more intensive love than motherly love.

This love for you was handed down to her children. We, dear uncle, love you; our love, respect and pride, is unlimited.

Accept greetings from all of us, a mostly from your true nephew.  
Uros.

page 263

**Postal Telegraph**

Marica Kosanovic to N. Tesla  
Tesla's sister

Plaski, Croatia  
Dec. 18, 1931

to Governor Clinton Hotel New York, NY

I think of you continually wishing you health always and a lot of optimism  
Marica Hugs you



Tesla's Correspondence with Rlaives PAGE 268  
Sava Kosanovic to N. Tesla  
Tesla's Nephew

Susak, Yugoslavia  
Oct. 6, 1935

Dear Uncle:

I know how much worry you have for mother, and how concerned about knowing about her, and I take the liberty to write to you about her.

As you had said once to me about mother and for yourself, that large earthquakes have to happen to disturb you. It really is so. The death of our Uncle Sava, whom you liked very much upset mother and she went to Susak<sup>1</sup> in a villa. She is now two months here and it is very beautiful. The home is very comfortable, there is much greenery around it and room for a park, and across the street is the sea, with a terrace and from the window a heavenly view of Kvarner Bay. City comfort with all its amenities. Mother always liked the city and the sea, and here she feels in her milieu, especially when she is in her own home. Her first wish was to, as soon as she came in her home to write you a detailed letter. Meanwhile she had an accident; she slipped on a rock here and broke the radius of her right hand. Now, after five weeks she healed completely and is now beginning to exercise. Because of this, she is not writing and is hardly waiting to write to you. Everyone of your dispatches were energized with animated anticipation and worry about you. Otherwise she is well. She is full of spirit. She heroically accepts life's attacks and she gives all of us strength in battle. An unusual intelligence and alert, she likes humor in her own element. She works hard physically always and does not want to do otherwise. A real sister of Tesla's. Every word about you is like an elixir for her and then feels that she is corrected. The three of us always gather around her, and not one had ignored her. We are proud that she is this kind of mother. In Plaski the home is very well repaired. Mother did all of this and even there behind Kapela mountain it is beautiful, like her by the sea.

PAGE 269

Mother jokes and uses your [...] non fueri in capite still they tell me that I am impractical and I have 2 homes.

Uncle's death had shook us up, but there was no help. For his physical strength he lived a long life. He died at our home in Plaski where his heart had always pointed and received our deepest love that he deserved who was such a noble character. He was bedridden for a few months and died of (Suga-diabetes)) of which there is enough in our family. He died giving benediction to mother and us, who were in his life the closest. Your telegram, which we received 10 days prior to his death and said that Tesla's dispatches had prolonged my life more than those injections. The situation here with us is normalizing, which means so much to our family and it is about seven years since we touched base and felt honored that I am your nephew.

Your telegram to mother was received, but without news. Brother Dragisa received a letter from Tomic? Mother will tell you what he said and she will write as soon as she can. Don't worry about her she is well and please try to write to her.

Mother sends her most greetings and kisses and says, that when you see this letter "thank God that this one doesn't reply often".

With Respect and Greetings. Yours Truly, Nephew Sava Kosanovic

1) Susak is a city next to Fiume under Yugoslavia. It is a resort town.

Translator's note: Dr. Sava Kosanovic was the leader of the Serbian Democratic Party in Croatia prior to WW II. He was a member of the Royal Government in Exile in London.

After WWII, he became the first post war Yugoslav ambassador to Washington, DC.

Kosanovic, Sava (Translator) - 1935



[He continued to work a great deal on his 80th birthday. He received congratulations from all over the world.]

[He spoke to the Yugoslavs in America in 1942 . Excerpts from other talks are given.]

[p. 48: Tesla's residence was 2 rooms on the 33rd floor of the New Yorker Hotel. The notice on the door stated, "No admission without permission." He was receiving a pension of \$ 600.00 from "our" state treasury. ]

transcribed by Nicholas (transcribed) - 11-1-11



[The automobile accident in 1939 resulted in 3 broken ribs. His nephew, Sava Kusanović, found him in poor condition. Tesla refused doctor's attention, insisting he knew his own constitution best and what was good for him. During his illness he was of clear mind and talked of Hitler and Mussolini, and in 1941 believed in the inevitable victory of Soviet Russia. He found the Ustashi crimes revolting and expressed himself about the necessity of a Serbo-Croatian-Slovenian union.]

Lawrence Nicholas (translator) - 1941



Tesla's Correspondence with Relatives PAGE 270  
**WESTERN UNION**

Marica Kosanovic to N. Tesla  
Tesla's sister

Susak, Yugoslavia  
Oct. 23, 1935

SENT TO HOTEL NEW YORKER, NEW ORK CITY  
Here your right hand loves you, Sister Marica.  
PAGE 271

**WESTERN UNION**

N. Tesla to Marica Kosanovic  
Tesla's sister

October 24, 1931  
New York, NY

SENT TO ISTARSKA ST. SUSAK, YUGOSLAVIA

HAPPILY AND HAPPY I SEND BROTHERLY GREETINGS., NIKOLA  
PAGE 272

**WESERN UNION CABLEGRAM**

Marica Kosnaovic to N. Tesla  
TESLA'S SISTER

January 6, 1936  
SUSAK, YUGOSLAVIA'

With sisterly love I greet you on the New Year and your nameday.  
Sister Marica  
PAGE 273

**western union telegram**

N. Tesla to Marica Kosanovic  
Tesla's sister

New York, NY  
May 25, 1936

Sent to Istarska St., Susak, Yugoslavia  
Again you made me happy. all is weel only that they don't send me up to heaven., Nikola  
PAGE 274

**POSTAL TELEGRAPH**

Marica Kosanovic to N. Tesla  
Tesla's Sister

Belgrade, Yugoslavia  
May 31, 1936

SENT TO HOTEL NEW YORKER

Wesnt to a great Dedication in Belgrde and I represented you. Ljubisa greets you, Sister  
Marica  
PAGE 275

N. Tesla to Marica Kosanovic  
Tesla's Sister

New York, NY  
June 1, 1936

Never a better representative andand your brother thanks you. Nikola  
PAGE 276

**COMMERCIAL CABLEGRAM**

Marica Kosanovic to N. Tesla  
Tesla's Sister

Susak, Yugoslavia  
Set. 29, 1936

I am completely cured with my tuberculosis and further for my great brother my 50 year battle  
and honor to Boksan. Will write more. Love, Marica Sister

Marica Kosanovic Nikola Tesla (after) - 1936



Tesla's Correspondence with Relatives PAGE 277  
COMMERCIAL CABLE

N. Tesla to Marica Kosanovic  
Tesla's Sister

New York, NY  
Oct. 29, 1936

SENT TO SUSAK, YUGOSLAVIA ISTARSKA 39

Representing me was too much for you. I am pleased to hear that you are well again. Take care of yourself ... I am very happy of a relative who helped me in a difficult struggle that the country and the government survive. Love You Brother Nikola  
PAGE 278

Nikola Trbojevic to N. Tesla  
Tesla's nephew

Detroit, MI  
Sept. 10, 1937

Dear Uncle:L

I am giving you sad and sorrowful news that our older son Jackie 13 years of age last Saturday fell from a high tree, broke his neck and died on the spot. The crushed Alice and me so much that it is difficult to write about it. We gave him a very beautiful burial last Tuesday[...] He had two requiem services, one in Serbian and one in Episcopalian. The whole procession was full of flowers, from strangers whom we did not even know and a Boy Scout troop were the pall bearers. I have now somewhat overcome it, but my wife is completely shattered and throws up every day ten times.

How are you, please write at least a few words. They write from home that in Yugoslavia people are saying that you may receive the Nobel Award this year. May God help you.

I was recently working on a new type of tooth wheel, i.e. a combination of spiral level gear and globoid worm and I made a few. It looks very good and can 'back lash' successfully.

At home all are well and they are in great fear of a war. Uncle Petar send his Greetings. Yours  
PAGE 279

Truly, nephew Niko la  
Nikola Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Oct. 4, 1937

Dear Uncle! :

I wrote you two weeks ago about the catastrophe that had happened to us about our Jackie falling from a tree and died. I don't know if you received that letter. We moved to a new address 1530 Edison Ave.. This home is in a very beautiful neighborhood. It has 10 rooms 9 bedrooms) air conditioning and have enough space, two radios, a good car, etc.

When you intend to move with us and live in peace and satisfaction in your older days. Alice and I hold you in deep respect and would comfort you. Think about it and let us know.

My things are not going so well, but, however I think that shortly I will break out of this lethargy and work again.

Hug You Your Nephew, Niko.

1937 Nov 10 (translater) - 1937



Tesla's Correspondence with Relatives PAGE 280

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
1938

LETTERHEAD Nikola Trbojevic  
7338 Woodward Ave.  
Detroit, MI

Dear Uncle:

Please accept the sad news that my aunt and your sister Marica passed away.  
Please accept my honest condolences. Her, now we see that one by one we are gone. Now,  
her three sons, not one married. This is how a great family tree will pass away.  
Why don't you reply ever with a word or two? How are you? They write from home and ask  
about you, and I cannot say anything. It is difficult enough for me here but I hope to swim out of  
it. My stomach always bothers me. Please answer with a few words.  
Your Nephew Greets you, Niko

PAGE 281

WESTERN UNION PRESS MESSAGE

Nikola Tesla to N. Trbojevic  
Tesla's Nephew

New York, NY  
no date

Nikola Trbojevic, 7338 Woodward Ave. Detroit, MI

I do not need your help. When I was in most dire straits you did not help. I cannot forget that you  
denigrate my integrity. I had two wishes one that after my death that you get my bust by  
Mestrovic and that you write a book about wheels. Mestrovic gladly agreed, but Detroit would  
die before you write a book. You have crazy luck that your uncle I know outstanding scientists  
who speak all of the major languages and a compeent technician a doctor of literature can be  
your secretary and co-worker, one must gather all the sources that you would do at these book  
sores interpret it technically and that the first book be in English and the Tesla Institute could  
translate it and sele it in our language and the work could be translated into other languages and  
complete your recommendations and we anticipate that you become a useful Serb and write to  
me soon. Don't worry about my illness, I am still working, Uncle Nikola  
(translator's note) Ivan Mestorvic was a world renowned sculptor and friend of Tesla's

PAGE 282

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Nov. 16, 1938

Dear Uncle:

Your telegram I just received, thank you. Concerning the book and wheels, I would for now put  
off and am now completing and completed three new things.that will help me financially they are:  
1. Front Wheel Drive(also Rear Wheel if the engine is in the rear) I do do notuse the  
conventional constant velocity universal joint which is expensive but a specially constructed  
oscillating bearing pivoted right in the axle. will send you blueprints as soon as I have some  
good ones. A basic patent of this idea already allowed.

2. Steering gear, 3. Hour glass worm for rear axles.

If this succeeds then I will be able to help you. Uncle Petar (Trbojevic) the judge is gravely ill.  
All at home are well but in great fear of a war.

Many Greetings, Nephew, Niko.

P.S. What kind of characteristic you mentioned? All of mine are from "hand to head".





206.

Никола Трбојевић - Управи хотела Њујоркер  
Детроит, 25. августа 1939.

Заглавље:

Nikola Trbojevič  
7338 Woodward Avenue  
Detroit, Michigan

Telephones  
Madison 4529 office  
Townsend 8 - 5669 home

Hotel New Yorker  
Attention of the Manager  
New York

Aug. 25, 1939

Gentleman: -

Regarding Mr. Nikola Tesla who resides in your hotel, please notify me in the case it would be necessary for me to go there to see him.

I am Mr. Tesla's nearest relative in this country, his nephew, and I am daily receiving letters from my sisters in Yugoslavia telling me that Mr. Tesla is seriously ill according to the rumors and notices which appeared in Yugoslav newspapers.

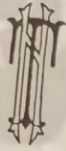
I wrote to Mr. Tesla some time ago but he did not answer. please find out from him if I could be of any help.

Yours very truly,

Nikola Trbojevič

Reference: Member Soc. Auto Eng'n's, etc.





Канцеларија Управника хотела - Николи Тесли  
Њујорк, 26. августа 1939.

Заглавље:

Hotel New Yorker

Thirty - Fourth Street at Eight Avenue, New York  
Office of Leo A. Molony, resident manager

Mr. Nikola Tesla  
Room 3327  
Hotel New Yorker

August 26, 1939

Dear Mr. Tesla:

We received the enclosed letter from Mr. Nikola Trbojevich, who states he is your nephew.

We are sending this letter to you so you may take whatever action you deem necessary or desirable.

With kind regards, we remain

Cordially yours,  
Leo A. Molony

Encl.

LAM: EM



Tesla's Correspondence with Relatives PAGE 283

N. Trbojevic to N. Tesla  
Tesla's Nephew

Letterhead

Nikola Trbojevic  
7338 Woodward Avenue  
Detroit, MI

July 14, 1939

Dear Uncle:

I heard that you are ill. How are you? Would you like to move to Detroit? Let me know how you are.

My work was slow up to now, but I just completed a good "universal joint" and "front wheel drive". I think that I will sell this patent by this summer.

PAGE 284

N. Trbojevic to Hotel New Yorker Manager  
Tesla's Nephew

Aug. 25, 1939  
Detroit, MI

IN ENGLISH

PAGE 285 TRANS. OF 284

Office of Hotel New Yorker  
Mr. N. Tesla  
Room 3327, Hotel New Yorker

PAGE 286

Aug. 26, 1939

Dear Mr. Tesla:

We received the enclosed letter from Mr. Nikola Trbojevic, who states he is your nephew. We are sending this letter to you so you may take whatever action you deem necessary or desirable.

With Kind Regards, we remain  
Cordially Yours, Leo A. Molony

PAGE 287 TRANS OF PAGE 286  
PAGE 288

N. Trbojevic to N. Tesla  
Tesla's nephew

Detroit, MI  
Sept. 1, 1939

Dear Uncle:

I received your telegram and all of the data, I was so pleased, that you are alive and well. I don't know who is spreading the news of your so called illness; sister Milica says that it was reported in the newspaper "vREME"

I am now in trouble and of concern. I have many patents and cannot sell not one. I just did my last one "constant velocity universal joint" which is run by taper rollers. It can increase the torque  $2 \frac{1}{2}$  more than present ones with wheels. This would be excellent for "front wheel drives", etc

I think that I can sell this, but nothing is sure in this America  
What do you think of Hitler in war? It is catastrophic for all sides.  
Love, Niko



Tesla's Correspondence with Relatives PAGE 291  
Mara Mucovic to N. Tesla  
Tesla's great niece

Sarajevo, Bosna  
July 29, 1939

My Dear Granfather:

Think about why I am now writing, and I would have written according to me a long time ago. I felt that I would be an intruder if I wrote to you as an orphan of a priest.

Today since I have married with a husband in good standing, I can write to you. I am the daughter of the late Gina and the late very Rev. Petar Lalic. You recognize her as an only child of your late sister and my Grandmother, Milka. The late grandmother Milka lived with my mother and father and where my father was a priest in Pazarica and now all of the three may god save their souls deceased.

I have one brother Nikola, and he received this name from my Grandmother-your sister the late Milka as a reminder of you the only brother! My brother received a Ph.D in Philosophy and suffered without parents and finally became employed as a Journalist in the Zagreb Press Bureau. For his intelligence this is not the best of jobs.

I married an Appellate Court Judge Simo Mucovic who was born in Reinje, Hercegovian and am happily married, because my husband is good and the same luck as my brother. He for his ability and years of service should be president of the Judicial court and not what he is today. You know that what people say: Give birth to me lucky mother and throw me into the water so that I can swim out of it.

As I look behind me I say: Your Dear God gave us what we already have.

PAGE 292

My dear grandfather you are my oldest relative and the closest and I would be happy if I can touch base with you and know how you are.

Thinking of you and I kiss your hand, Your Greatniece, Mara

PAGE 293

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Aug. 20, 1940

Dear Uncle:

Here, now my luck has turned for the better since I received a good contract from Spicer Mfg. Co. in Toledo, Ohio. I shall work (and an agreement) two of my inventions which I think are good and will have a significant input in the construction of automobile trucks, gyroscopes, etc. The first is the constant velocity universal joint, which contains of 4 pieces from which two are screws. The other is a new type of hypoid gear that will be cut at Fellows Gear Shaper. When there is progress if my stomach or some other catastrophe hits, I will tell you about it.

I had a lot of suffering until I had these two problems solved. About the universal joint I worked six years and tried all possible (like Edison) things until I saw clearly the truth.

How are you? How is your health? I am very concerned about the war and ours at home who are in serious danger.

Please write from time to time. I will have this office for a time until I see how things go. They (Spicer) pay me very well and have a possibility of good royalties.

Hug you you Nephew, Niko.

K. M. Novich  
M. J. J. S. (Translator) - 1941



Tesla's Correspondence with Relatives PAGE 298

March 4, 1942

Western Union

N. Tesla to Sava Kosanovic

New York, NY

March 2, 1941

Poor with words I still didn't explain it enough it would be necessary to increase up to twelve stations eight for Croatia each of the same construction like at Wardenclyffe and only 20 meters a ball five meters in diameter the station would be using diesel oil for energy with mechanical action my air turbines, steam powered, electrically or other manner and transformed into electrical alternating current under pressure sixty billion volts without danger. I am waiting for Governor Subasic select one station on top of Mt. Lovcen<sup>1</sup>. There will not be any light, electrical energy will deliver particles through space with the speed of 118837370000 centimeters per second. This is .394579 the speed of light. As I said about airplanes it can be used for tanks, trucks, automobiles, various machines in factories, wheels with hydro electrical and unlimited other machines. The particles can be larger than that of the diameter of an Hydrogen atom and with them metals in all kinds of materials send to all distances and good results in war and bring about peace. Particles are practical with neutrons, because 3723 times lighter than electricity or electrons

PAGE 299

that cannot penetrate space for great distances. In my attempts with 20 effective million volts electrons carried 40 times more electricity than normally and penetrated two meters in depth and terrible damage in a moment each pipe I have to finish because that I give you a fresh view. Warmly Greetings. I remain your Uncle, Nikola

PAGE 300

N. Trbojevic to N. Tesla  
Tesla's Nephew

letterhead

Toledo, Ohio

June 16, 1941

Nikola Trbojevic  
Mechanical Engineer  
4100 Bennett Road  
Toledo, Ohio, Spicer Eng. Co.

Dear Uncle:

Your telegram of last Saturday I received this morning. (Monday) We do not work Sunday's. I go here with my real name and not Terbo. I am surprised about your article that you are planning for Srbobran. You are too late for this, because our poor Yugoslavia is no more. Our Lika and Dalmatia are now under Italy. It is now the best to keep quiet and bear it.

I have been very fortunate with my invention because I received "interference" at the Patent Office, and don't know what it is and will not know for a month. The wife's operation was not too successful and now she has complications.

I am sending you a check for \$50,000 that is all I can put together. What are your difficulties? Did you lose your income?

I still have two more inventions besides this Universal Joint, Will see you., Your Niko

1) Mt. Lovcen is the highest peak in Montenegro.



BEGINNING "ACROSS ASIA ON A BICYCLE."

VOL. XLVIII.

MAY, 1894.

No. 1.

# THE CENTURY ILLUSTRATED • MONTHLY • MAGAZINE



M D C C C X C I V  
THE CENTURY CO. UNION SQUARE. NEW YORK  
T. FISHER UNWIN. PATERNOSTER SQ. LONDON

Copyright, 1894, by The Century Co. (Trade-Mark Registered Oct. 18th, 1881.) [Entered at N. Y. Post Office as Second Class Mail Matter.]



## ZMAI IOVAN IOVANOVICH.

THE CHIEF SERVIAN POET.



ARDLY is there a nation which has met with a sadder fate than the Servian. From the height of its splendor, when the empire embraced almost the entire northern part of the Balkan peninsula and a large portion of the territory now belonging to Austria, the Servian nation was plunged into abject slavery, after the fatal battle of 1389 at the Kosovo Polje, against the overwhelming Asiatic hordes. Europe can never repay the great debt it owes to the Servians for checking, by the sacrifice of their own liberty, the barbarian influx. The Poles at Vienna, under Sobieski, finished what the Servians attempted, and were similarly rewarded for their service to civilization.

It was at the Kosovo Polje that Milosh Obilich, the noblest of Servian heroes, fell, after killing the sultan Murat II. in the very midst of his great army. Were it not that it is a historical fact, one would be apt to consider this episode a myth, evolved by contact with the Latin and Greek races. For in Milosh we see both Mucius and Leonidas, and, more than this, a martyr, for he does not die an easy death on the battle-field like the Greek, but pays for his daring deed with a death of fearful torture. It is not astonishing that the poetry of a nation capable of producing such heroes should be pervaded with a spirit of nobility and chivalry. Even the indomitable Marko Kraljevic, the later incarnation of Servian heroism, when vanquishing Musa, the Moslem chief, exclaims, "Woe unto me, for I have killed a better man than myself!"

From that fatal battle until a recent period, it has been black night for the Servians, with but a single star in the firmament — Montenegro. In this gloom there was no hope for science, commerce, art, or industry. What could they do, this brave people, save to keep up the weary fight against the oppressor? And this they did unceasingly, though the odds were twenty to one. Yet fighting merely satisfied their wilder instincts. There was one more thing they could do, and did: the noble feats of their ancestors, the brave deeds of those who fell in the struggle for liberty, they embodied in immortal song. Thus circumstances and innate qualities made the Servians a nation of thinkers and poets, and thus, gradually, were evolved their magnificent national poems, which were first collected by

their most prolific writer, Vuk Stefanovich Karajich, who also compiled the first dictionary of the Servian tongue, containing more than 60,000 words. These national poems Goethe considered fit to match the finest productions of the Greeks and Romans. What would he have thought of them had he been a Servian?

While the Servians have been distinguished in national poetry, they have also had many individual poets who attained greatness. Of contemporaries, there is none who has grown so dear to the younger generation as Zmai Iovan Iovanovich. He was born in Novi Sad (Neusatz), a city at the southern border of Hungary, on November 24, 1833. He comes from an old and noble family, which is related to the Servian royal house. In his earliest childhood he showed a great desire to learn by heart the Servian national songs which were recited to him, and even as a child he began to compose poems. His father, who was a highly cultivated and wealthy gentleman, gave him his first education in his native city. After this he went to Budapest, Prague, and Vienna, and in these cities he finished his studies in law. This was the wish of his father, but his own inclinations prompted him to take up the study of medicine. He then returned to his native city, where a prominent official position was offered him, which he accepted, but so strong were his poetical instincts that a year later he abandoned the post to devote himself entirely to literary work.

His literary career began in 1849, his first poem being printed in 1852, in a journal called "Srbski Letopis" ("Servian Annual Review"); to this, and to other journals, notably "Neven" and "Sedmica," he contributed his early productions. From that period until 1870, besides his original poems, he made many beautiful translations from Petefy and Arany, the two greatest of the Hungarian poets, and from the Russian of Lermontof, as well as from German and other poets. In 1861 he edited the comic journal, "Komarac" ("The Mosquito"), and in the same year he started the literary journal, "Javor," and to these papers he contributed many beautiful poems. He had married in 1861, and during the few happy years that followed he produced his admirable series of lyrical poems called "Giulich," which probably remain his masterpiece. In 1862, greatly to his regret, he discontinued his beloved jour-

nal, "Javor,"  
him by the  
was then a  
to insure t  
In 1863  
national in  
Budapest.  
of medicir  
gree of do  
not relax  
nymen, m  
productio  
to nouris  
During h  
literary s  
president  
tion of hi  
In 1866  
mal, "Zm  
popular  
own. In  
given wit  
great pai  
his only  
affected  
deeply s  
diately f  
comic jo  
1877 he  
Russo-1  
popular

In the  
Feruz  
And spr  
The can  
Upon hi  
And ter

He calls  
"The k  
Cannot  
There i  
Where  
Had I  
They ex  
And ha

"Pacha  
Do not  
Where  
Majo to  
And bu  
if thy t



literary work. His literary career began in 1849, his first poem being printed in 1852, in a journal called "Slovianopis" ("Servian Annual Review"). In addition to other journals, notably "Novi Vremesnik," he contributed his early poems from that period until 1874, when he began to publish poems, he made many translations from Petefy and Arany, the great Hungarian poets, and from the Russian Lermontof, as well as from the German and other poets. In 1861 he edited the first issue of a magazine called "The Moslava," and in the same year he started the literary journal, "Komarac" ("The Arrow"). He had many papers he contributed to, and to these papers he contributed his most beautiful poems. He had many friends, and during the few happy years he lived he produced his admirable series of poems called "Gutlich," which proved to be his masterpiece. In 1869, from illness, he discontinued his beloved work.

## 131

In 1864 he started his famous satirical journal, "Zmai" ("The Dragon"), which was so popular that the name became a part of his own. In 1866 his comic play "Sharan" was given with great success. In 1872 he had the great pain of losing his wife and, shortly after, his only child. How much these misfortunes affected him is plainly perceptible from the deeply sad tone of the poems which immediately followed. In 1873 he started another comic journal, the "Ziza." During the year 1877 he began an illustrated chronicle of the Russo-Turkish war, and in 1878 appeared his popular comic journal, "Starmali." During all

The poems of Zmai are so essentially Serbian that to translate them into another tongue appears next to impossible. In keen satire free from Voltairian venom, in good-hearted and spontaneous humor, in delicacy and depth of expression, they are remarkable. Mr. Johnson has undertaken the task of versifying a few of the shorter ones after my literal and inadequate readings. Close translation being often out of the question, he has had to paraphrase, following as nearly as possible the original motives and ideas. In some instances he has expanded in order to complete a picture or to add a touch of his own. The four poems which follow will give some idea of the versatility of the Serbian poet, but come far short of indicating his range.

PARAPHRASES FROM THE SERVIAN.<sup>1</sup>

THE THREE GIAOURS.

"Pacha, wait till the morning light!  
Do not go down that fearful flight  
Where every step is a dead man's moan!  
Mujo to-morrow will gather each bone  
And bury it deep. Let the Giaours freeze  
If thy bed be warm."

Ugh! what a blast from the dungeon dank! —  
From the place where Hunger and Death were wed;  
Whence even the snakes by instinct fled,  
While the very lizards crouched and shrank  
In a chill of terror. 'T is inky black,  
All rights reserved.

<sup>1</sup> Copyright, 1894, by Robert Underwood Johnson. All rights reserved.



And icy cold, but he cannot go back,  
For there, as though the darkness flowers —  
There sit the skeletons of three Giaours  
Ghost-white in the flickering candle-gleam! —  
(Or is it the remnant of his dream?)  
About a stone that is green with mold  
They sit in a group, and their fingers hold  
Full glasses, and as the glasses clink  
The first Giaour beckons him to drink.

"Pacha, here is a glass for thee!  
When last on me the sunlight shone  
I had a wife who was dear to me.  
She was alone — no, not alone;  
The blade in her hand was her comrade true,  
As she came to your castle, seeking you.

"And when she came to your castle gate  
She dared you forth, but you would not go.  
Fiend and coward, you could not wait  
For a woman's wrath, but shot her, so.  
Her heart fell down in a piteous flood.  
This glass is filled with her precious blood.

"See how fine as I hold it up!  
Drink, Feruz Pacha, the brimming cup!"

Spellbound the Pacha now draws nigh;  
He empties the glass with a sudden cry:  
The skeletons drink with a laugh and toss,  
And they make the sign of the holy cross.

Then speaks the second of the dead:

"When to this darkness I was led,  
My mother asked, 'What sum will give  
Your prisoner back to the sun?' You said,  
'Three measures of gold, and the dog shall live.'  
Through pinching toil by noon and night  
She saved and saved till her hope grew bright.

"But when she brought you the yellow hoard,  
You mocked at the drops on her tired brow,  
And said, 'Toward the pay for his wholesome  
board  
Of good round stones I will this allow.'  
She died while her face with toil was wet.  
This glass is filled with her faithful sweat.

"See how fine as I hold it up!  
Drink, Feruz Pacha, the brimming cup!"

Haggard the Pacha now stands by;  
He drains the glass with a stifled cry:  
Again they drink with a laugh and toss,  
And the third one says, as his comrades cross:

"When this black shadow on me fell,  
There sang within my mountain home  
My one pale lad. Bethought him well  
That he would to my rescue come;  
But when he tried to lift the gun  
He tottered till the tears would run.

"Though vengeance sped his weary feet,  
Too late he came. Then back he crept,—  
Forgot to drink, forgot to eat,—  
And no slow moment went unwept.  
He died of grief at his meager years—  
This glass is laden with his tears.

"See how fine as I hold it up!  
Drink, Feruz Pacha, the brimming cup!"

The Pacha staggers; he holds it high;  
He drinks; he falls with a moan and cry:  
They laugh, they cross, but they drink no more—  
For the dead in the dungeon-cave are four.

### THE GIPSY PRAISES HIS HORSE.

You're admiring my horse, sir, I see.  
He's so light that you'd think it's a bird,  
Say a swallow. Ah, me!  
He's a prize!  
It's absurd  
To suppose you can take him all in as he passes  
With the best pair of eyes,  
Or the powerful aid  
Of your best pair of glasses:  
Take 'em off, and let's trade.

What! "Is Selim as good as he seems?"  
Never fear,  
Uncle dear,  
He's as good as the best of your dreams,  
And as sound as your sleep.  
It's only that kind that a gipsy would keep.  
The emperor's stables can't furnish his mate.  
But his grit and his gait,  
And his wind and his ways,  
A gipsy like me does n't know how to praise.  
But (if truth must be told)  
Although you should cover him over with gold  
He'd be worth one more sovereign still.

Oh, don't look at his teeth, my dear sir!  
I never have seen 'em myself.  
Age has nothing to do with an elf;  
So it's fair to infer  
My fairy can never grow old.  
Oh, don't look — (Here, my friend,  
Will you do me the kindness to hold  
For a moment these reins while I tend  
To that fly on his shanks?) . . .  
As I said — (Ah — now — thanks!)  
The longer you drive  
The better he'll thrive.  
He'll never be laid on the shelf!  
The older that colt is, the younger he'll grow.  
I've tried him for years, and I know.

"Eat? Eat?" do you say?  
Oh, that nag is n't nice  
About eating! Whatever you have will suffice.  
He takes everything raw —  
Some oats or some hay,  
Or a small wisp of straw,  
If you have it. If not, never mind —  
Selim won't even neigh.  
What kind of a feeder is he? That's the kind!

"Is he clever at jumping a fence?"  
What a question to ask! He's immense  
At a leap!  
How absurd!  
Why, the trouble's to keep  
Such a Pegasus down to the ground.  
He takes every fence at a bound  
With the grace of a bird;  
And so great is his strength,  
And so keen is his sense,  
He goes over a fence  
Not across, but the way of its length!

"Under saddle?" No saddle for Selim!  
Why, you've only to mount him, and feel him  
Fly level and steady, to see  
What disgrace that would be.  
No, you could n't more deeply insult him, unless  
You attempted to guess  
And pry into his pedigree.

Now why should you speak of his eyes?  
Does he seem like a horse that would need  
An eye-glass to add to his speed

Oh, perchance, to look wi  
No, indeed.  
Why, not only 's the  
Just the same as the day,  
But he knows all tha  
Both before and behind,  
Oh, he does n't need

"Has he any defect?"  
That is why, my de  
You know very well  
It is only the horse that  
That has glanders, or spr  
It is because not a  
Of defect or of deat  
Alas! not for gipsies th  
And now about speed.  
Just listen — I'll tell y

Coming home from Er  
A terrible storm o  
There was nothing  
Like the blackness of ni  
Though he'd had a ha  
Then the lightning  
And the thunder  
With a terrible di  
They were eager to cat  
Squint back to make s  
Well, this made the st  
And we raced and we  
And he would  
At last when we got t  
At the end of the  
By the stream where  
And the boys from th  
At a word he sto  
To be hugged by the  
We had beaten t  
And Selim was dry a  
Just a little bit d

MYS'

INTO the ai  
She, afar  
Sighs that,  
Each went  
Till the s

When each  
On a sta  
Jasmine, ti  
Both withi  
A lover'

Readers will be rem  
Islands, and recorded i  
driver, but the dog was



THE SERVIAN.  
 YOU'RE THE GIPSY PRAISES HIS HORSE.  
 He's so light that you'd think it's a swallow.  
 He's a prize!  
 It's absurd!  
 Suppose you can take him all in as he goes.  
 Or the best pair of eyes,  
 Your best pair of glasses:  
 Take 'em off, and let 's trade.  
 "Is Selim as good as he seems?"  
 Never fear,  
 Uncle dear,  
 's as good as the best of your dreams.  
 And as sound as your sleep.  
 It's only that kind that a gipsy would love  
 emperor's stables can't furnish his mate.  
 And his grit and his gait,  
 A gipsy like me does n't know how to praise  
 if truth must be told)  
 ough you should cover him over with gold  
 I be worth one more sovereign nail.

"Is he old?"  
 never have seen 'em myself.  
 ge has nothing to do with an elf;  
 So it's fair to infer  
 ry can never grow old.  
 n't look — (Here, my friend,  
 u do me the kindness to hold  
 noment these reins while I tend  
 that fly on his shanks?) . . .  
 I said — (Ah — now — thanks!)  
 he longer you drive  
 he better he'll thrive.  
 ever be laid on the shelf!  
 older that colt is, the younger he'll grow.  
 I tried him for years, and I know.

"What?" do you say?  
 nag is n't nice  
 ing! Whatever you have will suffice  
 icks everything raw —  
 or some hay,  
 small wisp of straw,  
 I have it. If not, never mind —  
 't even neigh.  
 of a feeder is he? That's the kind!

er at jumping a fence?"  
 uestion to ask! He's immense  
 ap!  
 bsurd!  
 he trouble 's to keep  
 us down to the ground.  
 ery fence at a bound  
 the grace of a bird;  
 great is his strength,  
 keen is his sense,  
 over a fence  
 ut the way of its length!

le?" No saddle for Selim!  
 only to mount him, and feel him  
 and steady, to see  
 grace that would be  
 n't more deeply insult him, make  
 I to guess  
 into his pedigree.  
 did you speak of his eyes?  
 men like a horse that would not  
 us to add to his speed

## PARAPHRASES FROM THE SERVIAN.

133

On perchance, to look wise?  
 No, indeed.  
 Why, not only 's the night to that steed  
 Just the same as the day,  
 But he knows all that passes —  
 Both before and behind, either way.  
 Oh, he does n't need glasses!

"Has he any defect?" What a question, my friend!  
 That is why, my dear sir, I am willing to sell.  
 You know very well  
 It is only the horse that you give or you lend  
 That has glanders, or springhalt, or something to mend:  
 'T is because not a breath  
 Of defect or of death  
 Can be found on my Selim that he 's at your pleasure.  
 Alas! not for gipsies the care of such treasure.

And now about speed. "Is he fast?" I should say!  
 Just listen — I'll tell you.

One equinox day,  
 Coming home from Erdout in the usual way,  
 A terrible storm overtook us. 'T was plain  
 There was nothing to do but to run for it. Rain,  
 Like the blackness of night, gave us chase. But that nag,  
 Though he 'd had a hard day, did n't tremble or sag.  
 Then the lightning would flash,  
 And the thunder would crash  
 With a terrible din.  
 They were eager to catch him; but he would just neigh,  
 Scent back to make sure, and then gallop away.  
 Well, this made the storm the more furious yet,  
 And we raced and we raced, but he was n't upset  
 And he would n't give in!  
 At last when we got to the foot of the hill  
 At the end of the trail,  
 By the stream where our white gipsy castle was set,  
 And the boys from the camp came a-waving their caps,  
 At a word he stood still,  
 To be hugged by the girls and be praised by the chaps.  
 We had beaten the gale,  
 And Selim was dry as a bone — well, perhaps,  
 Just a little bit damp on the tip of his tail.<sup>1</sup>

### MYSTERIOUS LOVE.

INTO the air I breathed a sigh;  
 She, afar, another breathed —  
 Signs that, like a butterfly,  
 Each went wandering low and high  
 Till the air with sighs was wreathed.

When each other long they sought,  
 On a star-o'er-twinkled hill  
 Jasmine, trembling with the thought,  
 Both within her chalice caught,  
 A lover's potion to distil.

Drank of this a nightingale,  
 Guided by the starlight wan —  
 Drank and sang from dale to dale,  
 Till every streamlet did exhale  
 Incense to the waking dawn.

Like the dawn, the maiden heard;  
 While, afar, I felt the fire  
 In the bosom of the bird;  
 Forth our sighs again were stirred  
 With a sevenfold desire.

These we followed till we learned  
 Where they trysted; there ere long  
 Their fond nightingale returned.  
 Deeper then our longings burned,  
 Deeper the delights of song.

Now, when at the wakening hour,  
 Sigh to sigh, we greet his lay,  
 Well we know its mystic power —  
 Feeling dawn and bird and flower  
 Pouring meaning into May.

Jasmine, perfume every grove!  
 Nightingale, forever sing  
 To the brightening dawn above  
 Of the mystery of love  
 In the mystery of spring!

### TWO DREAMS.

DEEP on the bosom of Jeel-Begzad  
 (Darling daughter of stern Bidar)  
 Sleeps the rose of her lover lad.  
 It brings this word: When the zenith-star  
 Melts in the full moon's rising light,  
 Then shall her Giaour come — to-night.

What is the odor that fills her room?  
 Ah! 't is the dream of the sleeping rose:  
 To feel his lips near its velvet bloom  
 In the secret shadow no moonbeam knows,  
 Till the maiden passion within her breast  
 Kindles to flame where the kisses rest.

By the stealthy fingers of old Bidar  
 (Savage father of Jeel-Begzad)  
 Never bloodless in peace or war  
 Was a handjar sheathed; and each one had  
 Graved on its handle a Koran prayer —  
 He can feel it now, in his ambush there!

The moon rides pale in the quiet night;  
 It puts out the stars, but never the gleam  
 Of the waiting blade's foreboding light,  
 Astir in its sheath in a horrid dream  
 Of pain, of blood, and of gasping breath,  
 Of the thirst of vengeance drenched in death.

The dawn did the dream of the rose undo,  
 But the dream of the sleeping blade came true.

Robert Underwood Johnson.

<sup>1</sup> Readers will be reminded by this conclusion of Mark Twain's story of the fast horse as told to him by Oudinot, of the Sandwich Islands, and recorded in "The Galaxy" for April, 1871. In that veracious narrative it is related that not a single drop fell on the driver, but the dog was swimming behind the wagon all the way.





VOL. LX

Recent Discoveries by Nikola Tesla.

VOL. LX, No. 2.

JUNE

PRICE, 35 CENTS.

# THE CENTURY ILLUSTRATED MONTHLY MAGAZINE



MACMILLAN AND CO. L'TD ST. MARTIN'S ST. LONDON  
THE CENTURY CO. UNION SQUARE. NEW YORK  
Copyright, 1900, by The Century Co. (Trade-Mark Registered Oct. 18th, 1881.) [Entered at N. Y. Post Office as Second Class Mail Matter.]



## THE PROBLEM OF INCREASING HUMAN ENERGY.

WITH SPECIAL REFERENCE TO THE HARNESSING  
OF THE SUN'S ENERGY.

BY NIKOLA TESLA.

ILLUSTRATED BY THE WRITER'S ELECTRICAL EXPERIMENTS, NOW FIRST PUBLISHED.

THE ONWARD MOVEMENT OF MAN—THE  
ENERGY OF THE MOVEMENT—THE THREE  
WAYS OF INCREASING HUMAN ENERGY.

OF all the endless variety of phenomena which nature presents to our senses, there is none that fills our minds with greater wonder than that inconceivably complex movement which, in its entirety, we designate as human life. Its mysterious origin is veiled in the forever impenetrable mist of the past, its character is rendered incomprehensible by its infinite intricacy, and its destination is hidden in the unfathomable depths of the future. Whence does it come? What is it? Whither does it tend? are the great questions which the sages of all times have endeavored to answer.

Modern science says: The sun is the past, the earth is the present, the moon is the future. From an incandescent mass we have originated, and into a frozen mass we shall turn. Merciless is the law of nature, and rapidly and irresistibly we are drawn to our doom. Lord Kelvin, in his profound meditations, allows us only a short span of life, something like six million years, after which time the sun's bright light will have ceased to shine, and its life-giving heat will have ebbed away, and our own earth will be a lump of ice, hurrying on through the eternal night. But do not let us despair. There will still be left on it a glimmering spark of life, and there will be a chance to kindle a new fire on some distant star. This wonderful possibility seems, indeed, to exist, judging from Professor Dewar's beautiful experiments with liquid air, which show that germs of organic life are not destroyed by cold, no matter how intense; consequently they may be transmitted through the interstellar space. Meanwhile the cheering lights of science and art, ever increasing in intensity, illuminate our path, and the marvels they disclose, and the enjoyments they offer,

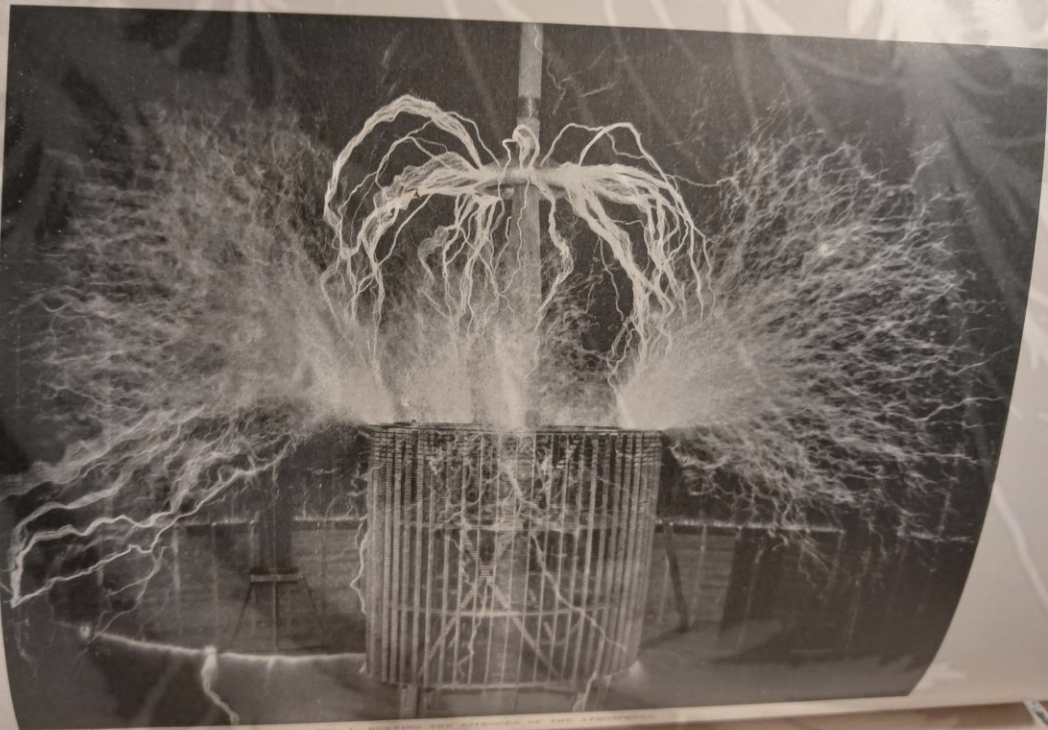
make us measurably forgetful of the gloomy future.

Though we may never be able to comprehend human life, we know certainly that it is a movement, of whatever nature it be. The existence of a movement unavoidably implies a body which is being moved and a force which is moving it. Hence, wherever there is life, there is a mass moved by a force. All mass possesses inertia, all force tends to persist. Owing to this universal property and condition, a body, be it at rest or in motion, tends to remain in the same state, and a force, manifesting itself anywhere and through whatever cause, produces an equivalent opposing force, and as an absolute necessity of this it follows that every movement in nature must be rhythmical. Long ago this simple truth was clearly pointed out by Herbert Spencer, who arrived at it through a somewhat different process of reasoning. It is borne out in everything we perceive—in the movement of a planet, in the surging and ebbing of the tide, in the reverberations of the air, the swinging of a pendulum, the oscillations of an electric current, and in the infinitely varied phenomena of organic life. Does not the whole of human life attest it? Birth, growth, old age, and death of an individual, family, race, or nation, what is it all but a rhythm? All life-manifestation, then, even in its most intricate form, as exemplified in man, however involved and inscrutable, is only a movement, to which the same general laws of movement which govern throughout the physical universe must be applicable.

When we speak of man, we have a conception of humanity as a whole, and before applying scientific methods to the investigation of his movement, we must accept this as a physical fact. But can any one doubt to-day that all the millions of individuals and all the innumerable types and characters constitute an entity, a unit? Though free to



**NOTE TO FIG. 1.**—This result is produced by the discharge of an electrical oscillator giving five million volts. The electrical pressure, attenuating one hundred thousand times per second, excites the normally inert nitrogen, causing it to combine with the oxygen. The flame-like discharges shown in the photograph measures sixty-five feet across.

[illegible]



think and act, we are held together, like the stars in the firmament, with ties inseparable. These ties we cannot see, but we can feel them. I cut myself in the finger, and it pains me: this finger is a part of me. I see a friend hurt, and it hurts me, too: my friend and I are one. And now I see stricken down an enemy, a lump of matter which, of all the lumps of matter in the universe, I care least for, and still it grieves me. Does this not prove that each of us is only a part of a whole?

For ages this idea has been proclaimed in the consummately wise teachings of religion, probably not alone as a means of insuring peace and harmony among men, but as a deeply founded truth. The Buddhist expresses it in one way, the Christian in another, but both say the same: We are all one. Metaphysical proofs are, however, not the only ones which we are able to bring forth in support of this idea. Science, too, recognizes this connectedness of separate individuals, though not quite in the same sense as it admits that the suns, planets, and moons of a constellation are one body, and there can be no doubt that it will be experimentally confirmed in times to come, when our means and methods for investigating psychical and other states and phenomena shall have been brought to great perfection. Still more: this one human being lives on and on. The individual is ephemeral, races and nations come and pass away, but man remains. Therein lies the profound difference between the individual and the whole. Therein, too, is to be found the partial explanation of many of those marvelous phenomena of heredity which are the result of countless centuries of feeble but persistent influence.

Conceive, then, man as a mass urged on by a force. Though this movement is not of a translatory character, implying change of place, yet the general laws of mechanical movement are applicable to it, and the energy associated with this mass can be measured, in accordance with well-known principles, by half the product of the mass with the square of a certain velocity. So, for instance, a cannon-ball which is at rest possesses a certain amount of energy in the form of heat, which we measure in a similar way. We imagine the ball to consist of innumerable minute particles, called atoms or molecules, which vibrate or whirl around one another. We determine their masses and velocities, and from them the energy of each of these minute systems, and adding them all together, we get

an idea of the total heat-energy contained in the ball, which is only seemingly at rest. In this purely theoretical estimate this energy may then be calculated by multiplying half of the total mass—that is, half of the sum of all the small masses—with the square of a velocity which is determined from the velocities of the separate particles. In like manner we may conceive of human energy being measured by half the human mass multiplied with the square of a velocity which we are not yet able to compute. But our deficiency in this knowledge will not vitiate the truth of the deductions I shall draw, which rest on the firm basis that the same laws of mass and force govern throughout nature.

Man, however, is not an ordinary mass, consisting of spinning atoms and molecules, and containing merely heat-energy. He is a mass possessed of certain higher qualities by reason of the creative principle of life with which he is endowed. His mass, as the water in an ocean wave, is being continuously exchanged, new taking the place of the old. Not only this, but he grows, propagates, and dies, thus altering his mass independently, both in bulk and density. What is most wonderful of all, he is capable of increasing or diminishing his velocity of movement by the mysterious power he possesses of appropriating more or less energy from other substance, and turning it into motive energy. But in any given moment we may ignore these slow changes and assume that human energy is measured by half the product of man's mass with the square of a certain hypothetical velocity. However we may compute this velocity, and whatever we may take as the standard of its measure, we must, in harmony with this conception, come to the conclusion that the great problem of science is, and always will be, to increase the energy thus defined. Many years ago, stimulated by the perusal of that deeply interesting work, Draper's "History of the Intellectual Development of Europe," depicting so vividly human movement, I recognized that to solve this eternal problem must ever be the chief task of the man of science. Some results of my own efforts to this end I shall endeavor briefly to describe here.

Let, then, in diagram *a*, *M* represent the mass of man. This mass is impelled in one direction by a force *f*, which is resisted by another partly frictional and partly negative force *R*, acting in a direction exactly opposite, and retarding the movement of the mass. Such an antagonistic force is present

oscillator giving twice  
or second, excites the  
charge shown in the



in every movement, and must be taken into consideration. The difference between these two forces is the effective force which imparts a velocity  $V$  to the mass  $M$  in the direction of the arrow on the line representing the force  $f$ . In accordance with the pre-

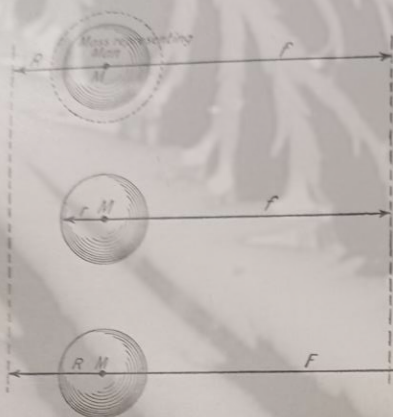


DIAGRAM G. THE THREE WAYS OF INCREASING HUMAN ENERGY.

ceding, the human energy will then be given by the product  $\frac{1}{2} MV^2 = \frac{1}{2} MV \times V$ , in which  $M$  is the total mass of man in the ordinary interpretation of the term "mass," and  $V$  is a certain hypothetical velocity, which, in the present state of science, we are unable exactly to define and determine. To increase the human energy is, therefore, equivalent to increasing this product, and there are, as will readily be seen, only three ways possible to attain this result, which are illustrated in the above diagram. The first way, shown in the top figure, is to increase the mass (as indicated by the dotted circle), leaving the two opposing forces the same. The second way is to reduce the retarding force  $R$  to a smaller value  $r$ , leaving the mass and the impelling force the same, as diagrammatically shown in the middle figure. The third way, which is illustrated in the last figure, is to increase the impelling force  $f$  to a higher value  $F$ , while the mass and the retarding force  $R$  remain unaltered. Evidently fixed limits exist as regards increase of mass and reduction of retarding force, but the impelling force can be increased indefinitely. Each of these three possible solutions presents a different aspect of the main problem of increasing human energy, which is thus divided into three distinct problems, to be successively considered.

#### THE FIRST PROBLEM: HOW TO INCREASE THE HUMAN MASS—THE BURNING OF ATMOSPHERIC NITROGEN.

VIEWED generally, there are obviously two ways of increasing the mass of mankind: first, by aiding and maintaining those forces and conditions which tend to increase it; and, second, by opposing and reducing those which tend to diminish it. The mass will be increased by careful attention to health, by of habits, by the promotion of marriage, by conscientious attention to the children, and, generally stated, by the observance of all the many precepts and laws of religion and hygiene. But in adding new mass to the old, three cases again present themselves. Either the mass added is of the same velocity as the old, or it is of a smaller or of a higher velocity. To gain an idea of the relative importance of these cases, imagine a train composed of, say, one hundred locomotives running on a track, and suppose that, to increase the energy of the moving mass, four more locomotives are added to the train. If these four move at the

same velocity at which the train is going, the total energy will be increased four per cent.; if they are moving at only one half of that velocity, the increase will amount to only one per cent.; if they are moving at twice that velocity, the increase of energy will be sixteen per cent. This simple illustration shows that it is of the greatest importance to add mass of a higher velocity. Stated more to the point, if, for example, the children be of the same degree of enlightenment as the parents,—that is, mass of the "same velocity,"—the energy will simply increase proportionately to the number added. If they are less intelligent or advanced, or mass of "smaller velocity," there will be a very slight gain in the energy; but if they are further advanced, or mass of "higher velocity," then the new generation will add very considerably to the sum total of human energy. Any addition of mass of "smaller velocity," beyond that indispensable amount required by the law expressed in the proverb, "Mens sana in corpore sano," should be strenuously opposed. For instance, the mere development of muscle, as aimed at in some of our colleges, I consider equivalent to adding mass of "smaller velocity," and I would not commend it, although my views were different when I was a student myself. Moderate exercise, insuring the right balance between

THE  
nied and body, and  
performance, is, of  
ment. The above  
most important res  
education, or the in  
of the mass newly  
Conversely, it sca  
everything that is  
religion and the la  
to decrease the m  
coffee, tobacco, and  
responsible for the  
many, and ought to  
But I do not thinl  
of suppression of  
many generations  
wiser to preach mo  
We have become a  
lants, and if such r  
they must be slow  
are devoting thei  
could make them  
turning their effor  
for instance, towa  
For every pers  
effects of a stimu  
die from the cons  
pure water. This  
infuses new life in  
vehicle through  
enter our bodies.  
it conveys are ene  
as they perform  
ceived. They sea  
and enjoy. The  
ignorant or carel  
the consequences  
that a philanthro  
forts better than  
those who are t  
By systematic  
tion of the drinki  
would be very c  
should be made a  
enforced by law—  
wise the drinking  
and public place  
not afford suffici  
tion. All ice fo  
artificially prepar  
sterilized. The  
germs of disease  
erally recognized  
improve the exis  
istactory method  
ties of water hi  
ward. By improv  
are now enabled  
and in large am



mind and body, and the highest efficiency of performance, is, of course, a prime requirement. The above example shows that the most important result to be attained is the education, or the increase of the "velocity," of the mass newly added.

Conversely, it scarcely need be stated that everything that is against the teachings of religion and the laws of hygiene is tending to decrease the mass. Whisky, wine, tea, coffee, tobacco, and other such stimulants are responsible for the shortening of the lives of many, and ought to be used with moderation. But I do not think that rigorous measures of suppression of habits followed through many generations are commendable. It is wiser to preach moderation than abstinence. We have become accustomed to these stimulants, and if such reforms are to be effected, they must be slow and gradual. Those who are devoting their energies to such ends could make themselves far more useful by turning their efforts in other directions, as, for instance, toward providing pure water.

For every person who perishes from the effects of a stimulant, at least a thousand die from the consequences of drinking impure water. This precious fluid, which daily infuses new life into us, is likewise the chief vehicle through which disease and death enter our bodies. The germs of destruction it conveys are enemies all the more terrible as they perform their fatal work unperceived. They seal our doom while we live and enjoy. The majority of people are so ignorant or careless in drinking water, and the consequences of this are so disastrous, that a philanthropist can scarcely use his efforts better than by endeavoring to enlighten those who are thus injuring themselves. By systematic purification and sterilization of the drinking-water the human mass would be very considerably increased. It should be made a rigid rule—which might be enforced by law—to boil or to sterilize otherwise the drinking-water in every household and public place. The mere filtering does not afford sufficient security against infection. All ice for internal uses should be artificially prepared from water thoroughly sterilized. The importance of eliminating germs of disease from the city water is generally recognized, but little is being done to improve the existing conditions, as no satisfactory method of sterilizing great quantities of water has as yet been brought forward. By improved electrical appliances we are now enabled to produce ozone cheaply and in large amounts, and this ideal disin-

fectant seems to offer a happy solution of the important question.

Gambling, business rush, and excitement, particularly on the exchanges, are causes of much mass-reduction, all the more so because the individuals concerned represent units of higher value. Incapacity of observing the first symptoms of an illness, and careless neglect of the same, are important factors of mortality. In noting carefully every new sign of approaching danger, and making conscientiously every possible effort to avert it, we are not only following wise laws of hygiene in the interest of our well-being and the success of our labors, but we are also complying with a higher moral duty. Every one should consider his body as a priceless gift from one whom he loves above all, as a marvelous work of art, of undescrivable beauty and mastery beyond human conception, and so delicate and frail that a word, a breath, a look, nay, a thought, may injure it. Uncleanliness, which breeds disease and death, is not only a self-destructive but a highly immoral habit. In keeping our bodies free from infection, healthful, and pure, we are expressing our reverence for the high principle with which they are endowed. He who follows the precepts of hygiene in this spirit is proving himself, so far, truly religious. Laxity of morals is a terrible evil, which poisons both mind and body, and which is responsible for a great reduction of the human mass in some countries. Many of the present customs and tendencies are productive of similar hurtful results. For example, the society life, modern education and pursuits of women, tending to draw them away from their household duties and make men out of them, must needs detract from the elevating ideal they represent, diminish the artistic creative power, and cause sterility and a general weakening of the race. A thousand other evils might be mentioned, but all put together, in their bearing upon the problem under discussion, they would not equal a single one, the want of food, brought on by poverty, destitution, and famine. Millions of individuals die yearly for want of food, thus keeping down the mass. Even in our enlightened communities, and notwithstanding the many charitable efforts, this is still, in all probability, the chief evil. I do not mean here absolute want of food, but want of healthful nutriment.

How to provide good and plentiful food is, therefore, a most important question of the day. On general principles the raising of cattle as a means of providing food is



mind and body, and the highest efficiency of performance, is, of course, a prime requirement. The above example shows that the most important result to be attained is the education, or the increase of the "velocity," of the mass newly added.

Conversely, it scarcely need be stated that everything that is against the teachings of religion and the laws of hygiene is tending to decrease the mass. Whisky, wine, tea, coffee, tobacco, and other such stimulants are responsible for the shortening of the lives of many, and ought to be used with moderation. But I do not think that rigorous measures of suppression of habits followed through many generations are commendable. It is wiser to preach moderation than abstinence. We have become accustomed to these stimulants, and if such reforms are to be effected, they must be slow and gradual. Those who are devoting their energies to such ends could make themselves far more useful by turning their efforts in other directions, as, for instance, toward providing pure water.

For every person who perishes from the effects of a stimulant, at least a thousand die from the consequences of drinking impure water. This precious fluid, which daily infuses new life into us, is likewise the chief vehicle through which disease and death enter our bodies. The germs of destruction it conveys are enemies all the more terrible as they perform their fatal work unperceived. They seal our doom while we live and enjoy. The majority of people are so ignorant or careless in drinking water, and the consequences of this are so disastrous, that a philanthropist can scarcely use his efforts better than by endeavoring to enlighten those who are thus injuring themselves. By systematic purification and sterilization of the drinking-water the human mass would be very considerably increased. It should be made a rigid rule—which might be enforced by law—to boil or to sterilize otherwise the drinking-water in every household and public place. The mere filtering does not afford sufficient security against infection. All ice for internal uses should be artificially prepared from water thoroughly sterilized. The importance of eliminating germs of disease from the city water is generally recognized, but little is being done to improve the existing conditions, as no satisfactory method of sterilizing great quantities of water has as yet been brought forward. By improved electrical appliances we are now enabled to produce ozone cheaply and in large amounts, and this ideal disin-

fectant seems to offer a happy solution of the important question.

Gambling, business rush, and excitement, particularly on the exchanges, are causes of much mass-reduction, all the more so because the individuals concerned represent units of higher value. Incapacity of observing the first symptoms of an illness, and careless neglect of the same, are important factors of mortality. In noting carefully every new sign of approaching danger, and making conscientiously every possible effort to avert it, we are not only following wise laws of hygiene in the interest of our well-being and the success of our labors, but we are also complying with a higher moral duty. Every one should consider his body as a priceless gift from one whom he loves above all, as a marvelous work of art, of undescrivable beauty and mastery beyond human conception, and so delicate and frail that a word, a breath, a look, nay, a thought, may injure it. Uncleanliness, which breeds disease and death, is not only a self-destructive but a highly immoral habit. In keeping our bodies free from infection, healthful, and pure, we are expressing our reverence for the high principle with which they are endowed. He who follows the precepts of hygiene in this spirit is proving himself, so far, truly religious. Laxity of morals is a terrible evil, which poisons both mind and body, and which is responsible for a great reduction of the human mass in some countries. Many of the present customs and tendencies are productive of similar hurtful results. For example, the society life, modern education and pursuits of women, tending to draw them away from their household duties and make men out of them, must needs detract from the elevating ideal they represent, diminish the artistic creative power, and cause sterility and a general weakening of the race. A thousand other evils might be mentioned, but all put together, in their bearing upon the problem under discussion, they would not equal a single one, the want of food, brought on by poverty, destitution, and famine. Millions of individuals die yearly for want of food, thus keeping down the mass. Even in our enlightened communities, and notwithstanding the many charitable efforts, this is still, in all probability, the chief evil. I do not mean here absolute want of food, but want of healthful nutriment.

How to provide good and plentiful food is, therefore, a most important question of the day. On general principles the raising of cattle as a means of providing food is



objectionable, because, in the sense interpreted above, it must undoubtedly tend to the addition of mass of a "smaller velocity." It is certainly preferable to raise vegetables, and I think, therefore, that vegetarianism is a commendable departure from the established barbarous habit. That we can subsist on plant food and perform our work even to advantage is not a theory, but a well-demonstrated fact. Many races living almost exclusively on vegetables are of superior physique and strength. There is no doubt that some plant food, such as oatmeal, is more economical than meat, and superior to it in regard to both mechanical and mental performance. Such food, moreover, taxes our digestive organs decidedly less, and, in making us more contented and sociable, produces an amount of good difficult to estimate. In view of these facts every effort should be made to stop the wanton and cruel slaughter of animals, which must be destructive to our morals. To free ourselves from animal instincts and appetites, which keep us down, we should begin at the very root from which they spring: we should effect a radical reform in the character of the food.

There seems to be no philosophical necessity for food. We can conceive of organized beings living without nourishment, and deriving all the energy they need for the performance of their life-functions from the ambient medium. In a crystal we have the clear evidence of the existence of a formative life-principle, and though we cannot understand the life of a crystal, it is none the less a living being. There may be, besides crystals, other such individualized, material systems of beings, perhaps of gaseous constitution, or composed of substance still more tenuous. In view of this possibility,—nay, probability,—we cannot apodictically deny the existence of organized beings on a planet merely because the conditions on the same are unsuitable for the existence of life as we conceive it. We cannot even, with positive assurance, assert that some of them might not be present here, in this our world, in the very midst of us, for their constitution and life-manifestation may be such that we are unable to perceive them.

The production of artificial food as a means for causing an increase of the human mass naturally suggests itself, but a direct attempt of this kind to provide nourishment does not appear to me rational, at least not for the present. Whether we could thrive

on such food is very doubtful. We are the result of ages of continuous adaptation, and we cannot radically change without unforeseen and, in all probability, disastrous sequences. So uncertain an experiment should not be tried. By far the best way, it seems to me, to meet the ravages of the evil, would be to find ways of increasing the productivity of the soil. With this object the preservation of forests is of an importance which cannot be overestimated, and in this connection, also, the utilization of water-power for purposes of electrical transmission, dispensing in many ways with the necessity of burning wood, and tending thereby to forest preservation, is to be strongly advocated. But there are limits in the improvement to be effected in this and similar ways.

To increase materially the productivity of the soil, it must be more effectively fertilized by artificial means. The question of food-production resolves itself, then, into the question how best to fertilize the soil. What it is that made the soil is still a mystery. To explain its origin is probably equivalent to explaining the origin of life itself. The rocks, disintegrated by moisture and heat and wind and weather, were in themselves not capable of maintaining life. Some unexplained condition arose, and some new principle came into effect, and the first layer capable of sustaining low organisms, like mosses, was formed. These, by their life and death, added more of the life-sustaining quality to the soil, and higher organisms could then subsist, and so on and on, until at last highly developed plant and animal life could flourish. But though the theories are, even now, not in agreement as to how fertilization is effected, it is a fact, only too well ascertained, that the soil cannot indefinitely sustain life, and some way must be found to supply it with the substances which have been abstracted from it by the plants. The chief and most valuable among these substances are compounds of nitrogen, and the cheap production of these is, therefore, the key for the solution of the all-important food problem. Our atmosphere contains an inexhaustible amount of nitrogen, and could we but oxidize it and produce these compounds, an incalculable benefit for mankind would follow.

Long ago this idea took a powerful hold on the imagination of scientific men, but an efficient means for accomplishing this result could not be devised. The problem was rendered extremely difficult by the extraordinary inertness of the nitrogen, which refuses to

combine even with oxygen. Electricity comes to our aid: the action of the electric current on the nitrogen of the atmosphere has been in effect for centuries without but little when once ignited, however, in producing electricity, will burn. It is, however, in producing electricity, that the nitrogen is so effectively excited. A very effective experiment was made by nitrogen until a comparison was made. In a lecture, a novel for the electrical flame named "the electric flame," which, besides being capacious in abundance, also pointed out on that occasion the quality of exciting chemical discharge or flame was the very feeble, and consequently oxidation of the nitrogen to intensify this action. Evidently electric current had to be produced in order to effect nitrogen combustion.

The first advance was in maintaining that the chemical discharge was very consistent by using currents of extremely high frequency or rate of vibration. An important improvement, however, was soon set afoot in this direction. The facts of the electrical present impulses, of their wave-characteristic features, were then the influence of the electric current and temperature and thus the best conditions for the most intense chemical action. The process of securing the high intensity of the electrical process were gradually coming; still, little by little, the improvements were becoming more and more important. The brush-discharge phenomenon, a roaring blaze, developed into a marvelous sixty or seventy feet across almost imperceptibly, possible means, but to what a degree it had been rewarded an idea made an inspection of Fig. 1 (p. 17) title, is self-explanatory.



combine even with oxygen. But here electricity comes to our aid: the dormant affinities of the element are awakened by an electric current of the proper quality. As a lump of coal which has been in contact with oxygen for centuries without burning will combine with it when once ignited, so nitrogen, excited by electricity, will burn. I did not succeed, however, in producing electrical discharges exciting very effectively the atmospheric nitrogen until a comparatively recent date, although I showed, in May, 1891, in a scientific lecture, a novel form of discharge or electrical flame named "St. Elmo's hotfire," which, besides being capable of generating ozone in abundance, also possessed, as I pointed out on that occasion, distinctly the quality of exciting chemical affinities. This discharge or flame was then only three or four inches long, its chemical action was likewise very feeble, and consequently the process of oxidation of the nitrogen was wasteful. How to intensify this action was the question. Evidently electric currents of a peculiar kind had to be produced in order to render the process of nitrogen combustion more efficient.

The first advance was made in ascertaining that the chemical activity of the discharge was very considerably increased by using currents of extremely high frequency or rate of vibration. This was an important improvement, but practical considerations soon set a definite limit to the progress in this direction. Next, the effects of the electrical pressure of the current impulses, of their wave-form and other characteristic features, were investigated. Then the influence of the atmospheric pressure and temperature and of the presence of water and other bodies was studied, and thus the best conditions for causing the most intense chemical action of the discharge and securing the highest efficiency of the process were gradually ascertained. Naturally, the improvements were not quick in coming; still, little by little, I advanced. The flame grew larger and larger, and its oxidizing action more and more intense. From an insignificant brush-discharge a few inches long it developed into a marvelous electrical phenomenon, a roaring blaze, devouring the nitrogen of the atmosphere and measuring sixty or seventy feet across. Thus slowly, almost imperceptibly, possibility became accomplishment. All is not yet done, by any means, but to what a degree my efforts have been rewarded an idea may be gained from an inspection of Fig. 1 (p. 176), which, with its title, is self-explanatory. The flame-like dis-

charge visible is produced by the intense electrical oscillations which pass through the coil shown, and violently agitate the electrified molecules of the air. By this means a strong affinity is created between the two normally indifferent constituents of the atmosphere, and they combine readily, even if no further provision is made for intensifying the chemical action of the discharge. In the manufacture of nitrogen compounds by this method, of course, every possible means bearing upon the intensity of this action and the efficiency of the process will be taken advantage of, and, besides, special arrangements will be provided for the fixation of the compounds formed, as they are generally unstable, the nitrogen becoming again inert after a little lapse of time. Steam is a simple and effective means for fixing permanently the compounds. The result illustrated makes it practicable to oxidize the atmospheric nitrogen in unlimited quantities, merely by the use of cheap mechanical power and simple electrical apparatus. In this manner many compounds of nitrogen may be manufactured all over the world, at a small cost, and in any desired amount, and by means of these compounds the soil can be fertilized and its productiveness indefinitely increased. An abundance of cheap and healthful food, not artificial, but such as we are accustomed to, may thus be obtained. This new and inexhaustible source of food-supply will be of incalculable benefit to mankind, for it will enormously contribute to the increase of the human mass, and thus add immensely to human energy. Soon, I hope, the world will see the beginning of an industry which, in time to come, will, I believe, be in importance next to that of iron.

#### THE SECOND PROBLEM: HOW TO REDUCE THE FORCE RETARDING THE HUMAN MASS—THE ART OF TELAUTOMATICS.

As before stated, the force which retards the onward movement of man is partly frictional and partly negative. To illustrate this distinction I may name, for example, ignorance, stupidity, and imbecility as some of the purely frictional forces, or resistances devoid of any directive tendency. On the other hand, visionariness, insanity, self-destructive tendency, religious fanaticism, and the like, are all forces of a negative character, acting in definite directions. To reduce or entirely to overcome these dissimilar retarding forces, radically different methods must be employed. One knows, for instance, what



combine even with oxygen. But here electricity comes to our aid: the dormant affinities of the element are awakened by an electric current of the proper quality. As a lump of coal which has been in contact with oxygen for centuries without burning will combine with it when once ignited, so nitrogen, excited by electricity, will burn. I did not succeed, however, in producing electrical discharges exciting very effectively the atmospheric nitrogen until a comparatively recent date, although I showed, in May, 1891, in a scientific lecture, a novel form of discharge or electrical flame named "St. Elmo's hotfire," which, besides being capable of generating ozone in abundance, also possessed, as I pointed out on that occasion, distinctly the quality of exciting chemical affinities. This discharge or flame was then only three or four inches long, its chemical action was likewise very feeble, and consequently the process of oxidation of the nitrogen was wasteful. How to intensify this action was the question. Evidently electric currents of a peculiar kind had to be produced in order to render the process of nitrogen combustion more efficient.

The first advance was made in ascertaining that the chemical activity of the discharge was very considerably increased by using currents of extremely high frequency or rate of vibration. This was an important improvement, but practical considerations soon set a definite limit to the progress in this direction. Next, the effects of the electrical pressure of the current impulses, of their wave-form and other characteristic features, were investigated. Then the influence of the atmospheric pressure and temperature and of the presence of water and other bodies was studied, and thus the best conditions for causing the most intense chemical action of the discharge and securing the highest efficiency of the process were gradually ascertained. Naturally, the improvements were not quick in coming; still, little by little, I advanced. The flame grew larger and larger, and its oxidizing action more and more intense. From an insignificant brush-discharge a few inches long it developed into a marvelous electrical phenomenon, a roaring blaze, devouring the nitrogen of the atmosphere and measuring sixty or seventy feet across. Thus slowly, almost imperceptibly, possibility became accomplishment. All is not yet done, by any means, but to what a degree my efforts have been rewarded an idea may be gained from an inspection of Fig. 1 (p. 176), which, with its title, is self-explanatory. The flame-like dis-

charge visible is produced by the intense electrical oscillations which pass through the coil shown, and violently agitate the electrified molecules of the air. By this means a strong affinity is created between the two normally indifferent constituents of the atmosphere, and they combine readily, even if no further provision is made for intensifying the chemical action of the discharge. In the manufacture of nitrogen compounds by this method, of course, every possible means bearing upon the intensity of this action and the efficiency of the process will be taken advantage of, and, besides, special arrangements will be provided for the fixation of the compounds formed, as they are generally unstable, the nitrogen becoming again inert after a little lapse of time. Steam is a simple and effective means for fixing permanently the compounds. The result illustrated makes it practicable to oxidize the atmospheric nitrogen in unlimited quantities, merely by the use of cheap mechanical power and simple electrical apparatus. In this manner many compounds of nitrogen may be manufactured all over the world, at a small cost, and in any desired amount, and by means of these compounds the soil can be fertilized and its productiveness indefinitely increased. An abundance of cheap and healthful food, not artificial, but such as we are accustomed to, may thus be obtained. This new and inexhaustible source of food-supply will be of incalculable benefit to mankind, for it will enormously contribute to the increase of the human mass, and thus add immensely to human energy. Soon, I hope, the world will see the beginning of an industry which, in time to come, will, I believe, be in importance next to that of iron.

#### THE SECOND PROBLEM: HOW TO REDUCE THE FORCE RETARDING THE HUMAN MASS—THE ART OF TELAUTOMATICS.

As before stated, the force which retards the onward movement of man is partly frictional and partly negative. To illustrate this distinction I may name, for example, ignorance, stupidity, and imbecility as some of the purely frictional forces, or resistances devoid of any directive tendency. On the other hand, visionariness, insanity, self-destructive tendency, religious fanaticism, and the like, are all forces of a negative character, acting in definite directions. To reduce or entirely to overcome these dissimilar retarding forces, radically different methods must be employed. One knows, for instance, what



a fanatic may do, and one can take preventive measures, can enlighten, convince, and possibly direct him, turn his vice into virtue; but one does not know, and never can know, what a brute or an imbecile may do, and one must deal with him as with a mass, inert, without mind, let loose by the mad elements. A negative force always implies some quality, not infrequently a high one, though badly directed, which it is possible to turn to good advantage; but a directionless, frictional force involves unavoidable loss. Evidently, then, the first and general answer to the above question is: turn all negative force in the right direction and reduce all frictional force.

There can be no doubt that, of all the frictional resistances, the one that most retards human movement is ignorance. Not without reason said that man of wisdom, Buddha: "Ignorance is the greatest evil in the world." The friction which results from ignorance, and which is greatly increased owing to the numerous languages and nationalities, can be reduced only by the spread of knowledge and the unification of the heterogeneous elements of humanity. No effort could be better spent. But however ignorance may have retarded the onward movement of man in times past, it is certain that, nowadays, negative forces have become of greater importance. Among these there is one of far greater moment than any other. It is called organized warfare. When we consider the millions of individuals, often the ablest in mind and body, the flower of humanity, who are compelled to a life of inactivity and unproductiveness, the immense sums of money daily required for the maintenance of armies and war apparatus, representing ever so much of human energy, all the effort uselessly spent in the production of arms and implements of destruction, the loss of life and the fostering of a barbarous spirit, we are appalled at the inestimable loss to mankind which the existence of these deplorable conditions must involve. What can we do to combat best this great evil?

Law and order absolutely require the maintenance of organized force. No community can exist and prosper without rigid discipline. Every country must be able to defend itself, should the necessity arise. The conditions of to-day are not the result of yesterday, and a radical change cannot be effected to-morrow. If the nations would at once disarm, it is more than likely that a state of things worse than war itself would follow.

Universal peace is a beautiful dream, but not at once realizable. We have seen recently that even the noble effort of the man invested with the greatest worldly power has been virtually without effect. And no wonder, for the establishment of universal peace is, for the time being, a physical impossibility. War is a negative force, and cannot be turned in a positive direction without passing through the intermediate phases. It is the problem of making a wheel rotating one way, turn in the opposite direction without slowing it down, stopping it, and speeding it up again the other way.

It has been argued that the perfection of guns of great destructive power will stop time, but now I believe this to be a profound mistake. Such developments will greatly modify, but not arrest it. On the contrary, I think that every new arm that is invented, every new departure that is made in this direction, merely invites new talent and skill, engages new effort, offers a new incentive, and so only gives a fresh impetus to further development. Think of the discovery of gunpowder. Can we conceive of any more radical departure than was effected by this innovation? Let us imagine ourselves living in that period: would we not have thought then that warfare was at an end, when the armor of the knight became an object of ridicule, when bodily strength and skill, meaning so much before, became of comparatively little value? Yet gunpowder did not stop warfare; quite the opposite—it acted as a most powerful incentive. Nor do I believe that warfare can ever be arrested by any scientific or ideal development, so long as similar conditions to those now prevailing exist, because war has itself become a science, and because war involves some of the most sacred sentiments of which man is capable. In fact, it is doubtful whether men who would not be ready to fight for a high principle would be good for anything at all. It is not the mind which makes man, nor is it the body; it is mind and body. Our virtues and our failings are inseparable, like force and matter. When they separate, man is no more.

Another argument, which carries considerable force, is frequently made, namely, that war must soon become impossible because the means of defense are outstripping the means of attack. This is only in accordance with a fundamental law which may be expressed by the statement that it is easier to destroy than to build. This law defines human capacities and human conditions.

THE PRO-  
Were these such that it w  
build than to destroy, man  
sisted, creating and accur  
limit. Such conditions are  
A being which could do th  
man; it might be a god. D  
have the advantage over  
By the use of new princip  
can render harbors imp  
attack, but we cannot by  
vent two war-ships meetin  
high sea. And then, if w  
to its ultimate developme  
the conclusion that it wo  
mankind if attack and  
oppositely related; for i  
even the smallest, could st  
a wall absolutely impene  
defy the rest of the world  
would surely be brought  
extremely unfavorable to  
is by abolishing all the ba  
rate nations and countrie  
is best furthered.

Again, it is contended  
advent of the flying-mach  
universal peace. This, too  
entirely erroneous view.  
is certainly coming, and  
conditions will remain th  
In fact, I see no reason w  
like Great Britain, migh  
air as well as the sea.  
to put myself on record  
not hesitate to say that  
see the establishment of a  
its center may not be fa  
But, for all that, men wi

The ideal development  
ple would ultimately lead  
tion of the whole energy  
potential, explosive ener  
electrical condenser. In  
energy could be maintain  
it would need to be much  
while incomparably more

As regards the secu  
against foreign invasion,  
note that it depends on  
and not on the absolute  
individuals or magnitude  
that, if every country  
war-force in the same  
would remain unaltered  
agreement with the obje  
minimum the war-force  
the present still imper  
masses, is absolut



a fanatic may do, and one can take preventive measures, can enlighten, convince, and possibly direct him, turn his vice into virtue; but one does not know, and never can know, what a brute or an imbecile may do, and one must deal with him as with a mass, inert, without mind, let loose by the mad elements. A negative force always implies some quality, not infrequently a high one, though badly directed, which it is possible to turn to good advantage; but a directionless, frictional force involves unavoidable loss. Evidently, then, the first and general answer to the above question is: turn all negative force in the right direction and reduce all frictional force.

There can be no doubt that, of all the frictional resistances, the one that most retards human movement is ignorance. Not without reason said that man of wisdom, Buddha: "Ignorance is the greatest evil in the world." The friction which results from ignorance, and which is greatly increased owing to the numerous languages and nationalities, can be reduced only by the spread of knowledge and the unification of the heterogeneous elements of humanity. No effort could be better spent. But however ignorance may have retarded the onward movement of man in times past, it is certain that, nowadays, negative forces have become of greater importance. Among these there is one of far greater moment than any other. It is called organized warfare. When we consider the millions of individuals, often the ablest in mind and body, the flower of humanity, who are compelled to a life of inactivity and unproductiveness, the immense sums of money daily required for the maintenance of armies and war apparatus, representing ever so much of human energy, all the effort uselessly spent in the production of arms and implements of destruction, the loss of life and the fostering of a barbarous spirit, we are appalled at the inestimable loss to mankind which the existence of these deplorable conditions must involve. What can we do to combat best this great evil?

Law and order absolutely require the maintenance of organized force. No community can exist and prosper without rigid discipline. Every country must be able to defend itself, should the necessity arise. The conditions of to-day are not the result of yesterday, and a radical change cannot be effected to-morrow. If the nations would at once disarm, it is more than likely that a state of things worse than war itself would follow.

Universal peace is a beautiful dream, but not at once realizable. We have seen recently that even the noble effort of the man invested with the greatest worldly power has been virtually without effect. And no wonder, for the establishment of universal peace is, for the time being, a physical impossibility. War is a negative force, and cannot be turned in a positive force, and without passing through the intermediate phases. It is the problem of making a rotating one way, turn in the opposite direction without slowing it down, stopping it, and speeding it up again the other way.

It has been argued that the perfection of guns of great destructive power will stop time, but now I believe this to be a profound mistake. Such developments will greatly modify, but not arrest it. On the contrary, I think that every new arm that is invented, every new departure that is made in this direction, merely invites new talent and skill, engages new effort, offers a new incentive, and so only gives a fresh impetus to further development. Think of the discovery of gunpowder. Can we conceive of any more radical departure than was effected by this innovation? Let us imagine ourselves living in that period: would we not have thought then that warfare was at an end, when the armor of the knight became an object of ridicule, when bodily strength and skill, meaning so much before, became of comparatively little value? Yet gunpowder did not stop warfare; quite the opposite—it acted as a most powerful incentive. Nor do I believe that warfare can ever be arrested by any scientific or ideal development, so long as similar conditions to those now prevailing exist, because war has itself become a science, and because war involves some of the most sacred sentiments of which man is capable. In fact, it is doubtful whether men who would not be ready to fight for a high principle would be good for anything at all. It is not the mind which makes man, nor is it the body; it is mind and body. Our virtues and our failings are inseparable, like force and matter. When they separate, man is no more.

Another argument, which carries considerable force, is frequently made, namely, that war must soon become impossible because the means of defense are outstripping the means of attack. This is only in accordance with a fundamental law which may be expressed by the statement that it is easier to destroy than to build. This law defines human capacities and human conditions.

THE PRO-  
Were these such that it w  
build than to destroy, man  
sisted, creating and accur  
limit. Such conditions are  
A being which could do th  
man; it might be a god. Di  
have the advantage over  
alone, it seems to me, can  
By the use of new princip  
can render harbors imp  
attack, but we cannot by  
vent two war-ships meetin  
high sea. And then, if w  
to its ultimate developme  
the conclusion that it wo  
mankind if attack and c  
oppositely related; for i  
even the smallest, could st  
a wall absolutely impene  
defy the rest of the world  
would surely be brought c  
extremely unfavorable to h  
is by abolishing all the ba  
rate nations and countrie  
is best furthered.

Again, it is contended  
advent of the flying-mach  
universal peace. This, too,  
entirely erroneous view.  
is certainly coming, and  
conditions will remain th  
In fact, I see no reason w  
like Great Britain, migh  
air as well as the sea.  
to put myself on record  
not hesitate to say that  
see the establishment of a  
its center may not be fa  
But, for all that, men wi

The ideal development  
ple would ultimately lead  
tion of the whole energy  
potential, explosive ener  
electrical condenser. In  
energy could be maintain  
it would need to be much  
while incomparably more

As regards the secu  
against foreign invasion,  
note that it depends on  
and not on the absolute  
individuals or magnitude  
that, if every country  
war-force in the same  
would remain unaltered  
agreement with the obje  
minimum the war-force  
the present still imper  
masses, is absolut



Were these such that it would be easier to build than to destroy, man would go on unresisted, creating and accumulating without limit. Such conditions are not of this earth. A being which could do this would not be a man; it might be a god. Defense will always have the advantage over attack, but this alone, it seems to me, can never stop war. By the use of new principles of defense we can render harbors impregnable against attack, but we cannot by such means prevent two war-ships meeting in battle on the high sea. And then, if we follow this idea to its ultimate development, we are led to the conclusion that it would be better for mankind if attack and defense were just oppositely related; for if every country, even the smallest, could surround itself with a wall absolutely impenetrable, and could defy the rest of the world, a state of things would surely be brought on which would be extremely unfavorable to human progress. It is by abolishing all the barriers which separate nations and countries that civilization is best furthered.

Again, it is contended by some that the advent of the flying-machine must bring on universal peace. This, too, I believe to be an entirely erroneous view. The flying-machine is certainly coming, and very soon, but the conditions will remain the same as before. In fact, I see no reason why a ruling power, like Great Britain, might not govern the air as well as the sea. Without wishing to put myself on record as a prophet, I do not hesitate to say that the next years will see the establishment of an "air-power," and its center may not be far from New York. But, for all that, men will fight on merrily.

The ideal development of the war principle would ultimately lead to the transformation of the whole energy of war into purely potential, explosive energy, like that of an electrical condenser. In this form the war-energy could be maintained without effort; it would need to be much smaller in amount, while incomparably more effective.

As regards the security of a country against foreign invasion, it is interesting to note that it depends only on the relative, and not on the absolute, number of the individuals or magnitude of the forces, and that, if every country should reduce the war-force in the same ratio, the security would remain unaltered. An international agreement with the object of reducing to a minimum the war-force which, in view of the present still imperfect education of the masses, is absolutely indispensable, would,

therefore, seem to be the first rational step to take toward diminishing the force retarding human movement.

Fortunately, the existing conditions cannot continue indefinitely, for a new element is beginning to assert itself. A change for the better is imminent, and I shall now endeavor to show what, according to my ideas, will be the first advance toward the establishment of peaceful relations between nations, and by what means it will eventually be accomplished.

Let us go back to the early beginning, when the law of the stronger was the only law. The light of reason was not yet kindled, and the weak was entirely at the mercy of the strong. The weak individual then began to learn how to defend himself. He made use of a club, stone, spear, sling, or bow and arrow, and in the course of time, instead of physical strength, intelligence became the chief deciding factor in the battle. The wild character was gradually softened by the awakening of noble sentiments, and so, imperceptibly, after ages of continued progress, we have come from the brutal fight of the unreasoning animal to what we call the "civilized warfare" of to-day, in which the combatants shake hands, talk in a friendly way, and smoke cigars in the entractes, ready to engage again in deadly conflict at a signal. Let pessimists say what they like, here is an absolute evidence of great and gratifying advance.

But now, what is the next phase in this evolution? Not peace as yet, by any means. The next change which should naturally follow from modern developments should be the continuous diminution of the number of individuals engaged in battle. The apparatus will be one of specifically great power, but only a few individuals will be required to operate it. This evolution will bring more and more into prominence a machine or mechanism with the fewest individuals as an element of warfare, and the absolutely unavoidable consequence of this will be the abandonment of large, clumsy, slowly moving, and unmanageable units. Greatest possible speed and maximum rate of energy-delivery by the war apparatus will be the main object. The loss of life will become smaller and smaller, and finally, the number of the individuals continuously diminishing, merely machines will meet in a contest without bloodshed, the nations being simply interested, ambitious spectators. When this happy condition is realized, peace will be assured. But, no matter to what degree of perfection rapid-



fire guns, high-power cannon, explosive projectiles, torpedo-boats, or other implements of war may be brought, no matter how destructive they may be made, that condition can never be reached through any such development. All such implements require men for their operation: men are indispensable parts of the machinery. Their object is to kill and to destroy. Their power resides in their capacity for doing evil. So long as men meet in battle, there will be bloodshed. Bloodshed will ever keep up barbarous passion. To break this fierce spirit, a radical departure must be made, an entirely new principle must be introduced, something that never existed before in warfare—a principle which will forcibly, unavoidably, turn the battle into a mere spectacle, a play, a contest without loss of blood. To bring on this result men must be dispensed with: machine must fight machine. But how accomplish that which seems impossible? The answer is simple enough: produce a machine capable of acting as though it were part of a human being—no mere mechanical contrivance, comprising levers, screws, wheels, clutches, and nothing more, but a machine embodying a higher principle, which will enable it to perform its duties as though it had intelligence, experience, reason, judgment, a mind! This conclusion is the result of my thoughts and observations which have extended through virtually my whole life, and I shall now briefly describe how I came to accomplish that which at first seemed an unrealizable dream.

A long time ago, when I was a boy, I was afflicted with a singular trouble, which seems to have been due to an extraordinary excitability of the retina. It was the appearance of images which, by their persistence, marred the vision of real objects and interfered with thought. When a word was said to me, the image of the object which it designated would appear vividly before my eyes, and many times it was impossible for me to tell whether the object I saw was real or not. This caused me great discomfort and anxiety, and I tried hard to free myself of the spell. But for a long time I tried in vain, and it was not, as I still clearly recollect, until I was about twelve years old that I succeeded for the first time, by an effort of the will, in banishing an image which presented itself. My happiness will never be as complete as it was then, but, unfortunately (as I thought at that time), the old trouble returned, and with it my anxiety. Here it was that the observations to which I refer began.

I noted, namely, that whenever the image of an object appeared before my eyes I had seen something which reminded me of it. In the first instances I thought this to be purely accidental, but soon I convinced myself that it was not so. A visual impression, consciously or unconsciously received, invariably preceded the appearance of the image. Gradually the desire arose in me to find out, every time, what caused the images to appear, and the satisfaction of this desire soon became a necessity. The next observation I made was that, just as these images followed as a result of something I had seen, so also the thoughts which I conceived were suggested in like manner. Again, I experienced the same desire to locate the image which caused the thought, and this search for the original visual impression soon grew to be a second nature. My mind became automatic, as it were, and in the course of years of continued, almost unconscious performance, I acquired the ability of locating every time and, as a rule, instantly the visual impression which started the thought. Nor is this all. It was not long before I was aware that also all my movements were prompted in the same way, and so, searching, observing, and verifying continuously, year after year, I have, by every thought and every act of mine, demonstrated, and do so daily, to my absolute satisfaction, that I am an automaton endowed with power of movement, which merely responds to external stimuli beating upon my sense organs, and thinks and acts and moves accordingly. I remember only one or two cases in all my life in which I was unable to locate the first impression which prompted a movement or a thought, or even a dream.

With these experiences it was only natural that, long ago, I conceived the idea of constructing an automaton which would mechanically represent me, and which would respond, as I do myself, but, of course, in a much more primitive manner, to external influences. Such an automaton evidently had to have motive power, organs for locomotion, directive organs, and one or more sensitive organs so adapted as to be excited by external stimuli. This machine would, I reasoned, perform its movements in the manner of a living being, for it would have all the chief mechanical characteristics or elements of the same. There was still the capacity for growth, propagation, and, above all, the mind which would be wanting to make the model complete. But growth was not necessary in this case, since a machine could be manufactured full-grown, so to

FIG. 2. THE FIRST  
A machine having all its bodily or trans-  
mission mechanism controlled from a distance with  
series of its own motive power, propelling  
series, all of which are controlled by trans-  
missions to a circuit carried by the boat and  
speak. As to the capacity for propagation,  
it could likewise be left out of consid-  
eration, for in the mechanical model it men-  
tioned a process of manufacture. Whether  
the automaton be of flesh and bone, or of wood  
and steel, it mattered little, provided it could  
perform all the duties required of it as an  
intelligent being. To do so, it must be  
an element corresponding to the human  
Vol. LX.—22.







FIG. 2. THE FIRST PRACTICAL TELAUTOMATON.

A machine having all its bodily or translatory movements and the operations of the interior mechanism controlled from a distance without wires. The crewless boat shown in the photograph contains its own motive power, propelling- and steering-machinery, and numerous other accessories, all of which are controlled by transmitting from a distance, without wires, electrical oscillations to a circuit carried by the boat and adjusted to respond only to these oscillations.

speaking. As to the capacity for propagation, it could likewise be left out of consideration, for in the mechanical model it merely signified a process of manufacture. Whether the automaton be of flesh and bone, or of wood and steel, it mattered little, provided it could perform all the duties required of it like an intelligent being. To do so, it had to have an element corresponding to the mind, which

would effect the control of all its movements and operations, and cause it to act, in any unforeseen case that might present itself, with knowledge, reason, judgment, and experience. But this element I could easily embody in it by conveying to it my own intelligence, my own understanding. So this invention was evolved, and so a new art came into existence, for which the name









FIG. 5. PHOTOGRAPHIC VIEW OF COILS RESPONDING TO ELECTRICAL OSCILLATIONS.

The picture shows a number of coils, differently attuned and responding to the vibrations transmitted to them through the earth from an electrical oscillator. The large coil on the right, discharging strongly, is tuned to the fundamental vibration, which is fifty thousand per second; the two larger vertical coils to twice that number; the smaller white wire coil to four times that number, and the remaining small coils to higher tones. The vibrations produced by the oscillator were so intense that they affected perceptibly a small coil tuned to the twenty-sixth higher tone.

distant "electrical oscillator." This circuit, in responding, however feebly, to the transmitted vibrations, affected magnets and other contrivances, through the medium of which were controlled the movements of the propeller and rudder, and also the operations of numerous other appliances.

By the simple means described the knowledge, experience, judgment—the mind, so to speak—of the distant operator were embodied in that machine, which was thus enabled to move and to perform all its operations with reason and intelligence. It behaved just like a blindfolded person obeying directions received through the ear.

The automaton so far constructed had "borrowed minds," so to speak, as each merely formed part of the distant operator who conveyed to it his intelligent orders; but this art is only in the beginning. I purpose to show that, however impossible it may now seem, an automaton may be contrived which will have its "own mind," and by this I mean that it will be able, independent of any operator, left entirely to itself, to perform, in response to external

influences affecting its sensitive organs, a great variety of acts and operations as if it had intelligence. It will be able to follow a course laid out or to obey orders given far in advance; it will be capable of distinguishing between what it ought and what it ought not to do, and of making experiences or, otherwise stated, of recording impressions which will definitely affect its subsequent actions. In fact, I have already conceived such a plan.

Although I evolved this invention many years ago and explained it to my visitors very frequently in my laboratory demonstrations, it was not until much later, long after I had perfected it, that it became known, when, naturally enough, it gave rise to much discussion and to sensational reports. But the true significance of this new art was not grasped by the majority, nor was the great force of the underlying principle recognized. As nearly as I could judge from the numerous comments which then appeared, the results I had obtained were considered as entirely impossible. Even the few who were disposed to admit the practicability of the





FIG. 6. PHOTOGRAPHIC VIEW OF THE ESSENTIAL PARTS OF THE ELECTRICAL OSCILLATOR USED IN THE EXPERIMENTS DESCRIBED.

invention saw in it merely an automobile torpedo, which was to be used for the purpose of blowing up battle-ships, with doubtful success. The general impression was that I contemplated simply the steering of such a vessel by means of Hertzian or other rays. There are torpedoes steered electrically by wires, and there are means of communicating without wires, and the above was, of course, an obvious inference. Had I accomplished nothing more than this, I should have made a small advance indeed. But the art I have evolved does not contemplate merely the change of direction of a moving vessel; it affords a means of absolutely controlling, in every respect, all the innumerable trans-latory movements, as well as the operations of all the internal organs, no matter how many, of an individualized automaton. Criticisms to the effect that the control of the automaton could be interfered with were made by people who do not even dream of the wonderful results which can be accomplished by the use of electrical vibrations. The world moves slowly, and new truths are difficult to see. Certainly, by the use of this principle, an arm for attack as well as defense may be provided, of a destructiveness all the greater as the principle is applicable

to submarine and aerial vessels. There is virtually no restriction as to the amount of explosive it can carry, or as to the distance at which it can strike, and failure is almost impossible. But the force of this new principle does not wholly reside in its destructiveness. Its advent introduces into warfare an element which never existed before—a fighting-machine without men as a means of attack and defense. The continuous development in this direction must ultimately make war a mere contest of machines without men and without loss of life—a condition which would have been impossible without this new departure, and which, in my opinion, must be reached as preliminary to permanent peace. The future will either bear out or disprove these views. My ideas on this subject have been put forth with deep conviction, but in a humble spirit.

The establishment of permanent peaceful relations between nations would most effectively reduce the force retarding the human mass, and would be the best solution of this great human problem. But will the dream of universal peace ever be realized? Let us hope that it will. When all darkness shall be dissipated by the light of science, when all nations shall be merged into one, and

THE PRO-  
cession shall be identi-  
cal, then there shall be one la-  
bor, one end, then the di-  
vinity.

THE THIRD PROBLEM: HOW  
MUCH ACCELERATING TE-  
THE HARNESSING OF THE  
Of the three possible solu-  
problem of increasing hum-  
ly far the most important  
only because of its intrinsic  
also because of its intima-  
the many elements and con-  
termine the movement of hi-  
to proceed systematically, i-  
ary for me to dwell on all  
tions which have guided me  
in my efforts to arrive at  
which have led me, step by  
suits I shall now describe.  
study of the problem an a-  
gation, such as I have ma-  
forces which determine th



FIG. 7. EXPERIMENT

The photograph shows three en-  
dowed in a local loop consisting  
loops and which is at a dis-  
The loop likewise include  
which is worked at least



patriotism shall be identical with religion, when there shall be one language, one country, one end, then the dream will have become reality.

THE THIRD PROBLEM: HOW TO INCREASE THE FORCE ACCELERATING THE HUMAN MASS—THE HARNESSING OF THE SUN'S ENERGY.

Of the three possible solutions of the main problem of increasing human energy, this is by far the most important to consider, not only because of its intrinsic significance, but also because of its intimate bearing on all the many elements and conditions which determine the movement of humanity. In order to proceed systematically, it would be necessary for me to dwell on all those considerations which have guided me from the outset in my efforts to arrive at a solution, and which have led me, step by step, to the results I shall now describe. As a preliminary study of the problem an analytical investigation, such as I have made, of the chief forces which determine the onward move-

ment, would be of advantage, particularly in conveying an idea of that hypothetical "velocity" which, as explained in the beginning, is a measure of human energy; but to deal with this specifically here, as I would desire, would lead me far beyond the scope of the present subject. Suffice it to state that the resultant of all these forces is always in the direction of reason, which, therefore, determines, at any time, the direction of human movement. This is to say that every effort which is scientifically applied, rational, useful, or practical, must be in the direction in which the mass is moving. The practical, rational man, the observer, the man of business, he who reasons, calculates, or determines in advance, carefully applies his effort so that when coming into effect it will be in the direction of the movement, making it thus most efficient, and in this knowledge and ability lies the secret of his success. Every new fact discovered, every new experience or new element added to our knowledge and entering into the domain of reason, affects the same and, therefore, changes



FIG. 7. EXPERIMENT TO ILLUSTRATE AN INDUCTIVE EFFECT OF AN ELECTRICAL OSCILLATOR OF GREAT POWER.

The photograph shows three ordinary incandescent lamps lighted to full candle-power by currents induced in a local loop consisting of a single wire forming a square of fifty feet each side, which includes the lamps, and which is at a distance of one hundred feet from the primary circuit energized by the oscillator. The loop likewise includes an electrical condenser, and is exactly attuned to the vibrations of the oscillator, which is worked at less than five per cent. of its total capacity.







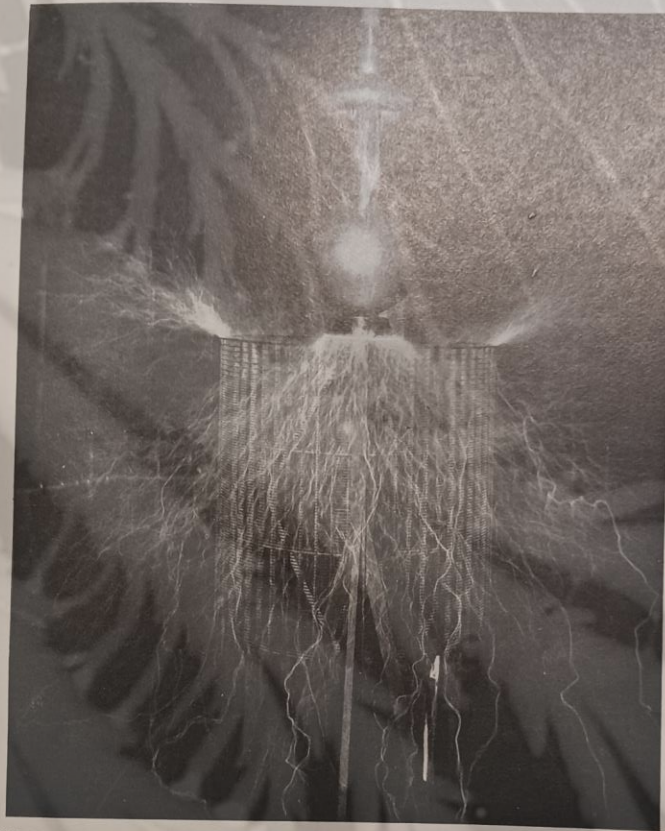


FIG. 9. EXPERIMENT TO ILLUSTRATE THE CAPACITY OF THE OSCILLATOR FOR CREATING A GREAT ELECTRICAL MOVEMENT.

The ball shown in the photograph, covered with a polished metallic coating of twenty square feet of surface, represents a large reservoir of electricity, and the inverted tin pan underneath, with a sharp rim, a big opening through which the electricity can escape before filling the reservoir. The quantity of electricity set in movement is so great that, although most of it escapes through the rim of the pan or opening provided, the ball or reservoir is nevertheless alternately emptied and filled to overflowing (as is evident from the discharge escaping on the top of the ball) one hundred and fifty thousand times per second.

the direction of the movement, which, however, must always take place along the resultant of all those efforts which, at that time, we designate as reasonable, that is, self-preserving, useful, profitable, or practical. These efforts concern our daily life, our necessities and comforts, our work and business, and it is these which drive man onward.

But looking at all this busy world about us, on all this complex mass as it daily throbs and moves, what is it but an immense clock-work driven by a spring? In the morning, when we rise, we cannot fail to note that all the objects about us are manufactured by machinery: the water we use is lifted by

steam-power; the trains bring our breakfast from distant localities; the elevators in our dwelling and in our office building, the cars that carry us there, are all driven by power; in all our daily errands, and in our very life-pursuit, we depend upon it; all the objects we see tell us of it; and when we return to our machine-made dwelling at night, lest we should forget it, all the material comforts of our home, our cheering stove and lamp, remind us how much we depend on power. And when there is an accidental stoppage of the machinery, when the city is snow-bound, or the life-sustaining movement otherwise temporarily arrested, we are affrighted to realize



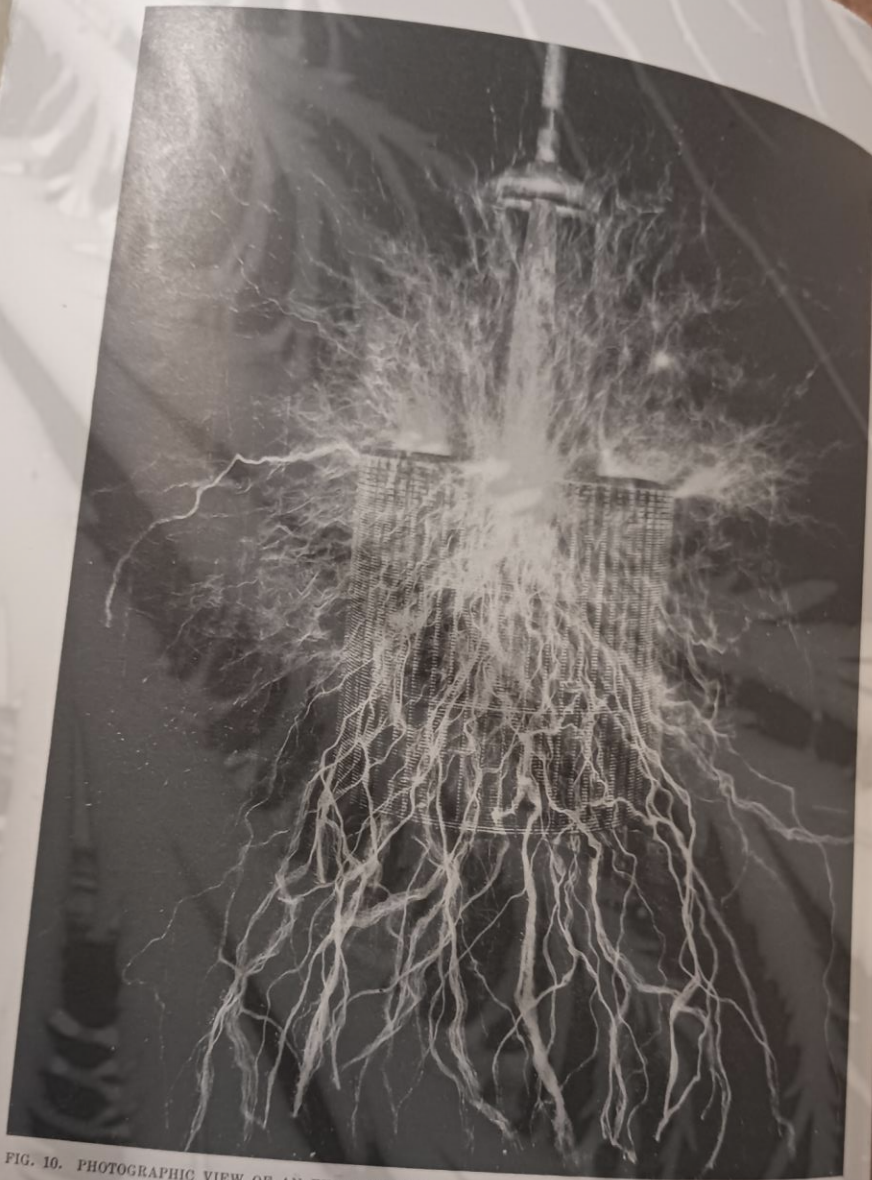


FIG. 10. PHOTOGRAPHIC VIEW OF AN EXPERIMENT TO ILLUSTRATE AN EFFECT OF AN ELECTRICAL OSCILLATOR DELIVERING ENERGY AT A RATE OF SEVENTY-FIVE THOUSAND HORSE-POWER.

The discharge, creating a strong draft owing to the heating of the air, is carried upward through the open roof of the building. The greatest width across is nearly seventy feet. The pressure is over twelve million volts, and the current alternates one hundred and thirty thousand times per second.

how impossible it would be for us to live the life we live without motive power. Motive power means work. To increase the force accelerating human movement means, therefore, to perform more work.

So we find that the three possible solutions of the great problem of increasing human energy are answered by the three words: *food, peace, work*. Many a year I have thought and pondered, lost myself in

## THE PROBLEM

speculations and theories, considering a mass moved by a force, an inexplicable movement in the principles of mechanics to the same until I arrived at the only to realize that they were in my early childhood. These would the key-notes of the Christ. Their scientific meaning and purpose clear to me: food to increase the force to diminish the retarding force to increase the force accelerating movement. These are the only things which are possible of that goal and all of them have one object, namely, to increase human energy. We recognize this, we cannot ignore how profoundly wise and how immensely practical religion is, and in what a mark stands in this respect to other. It is unmistakably the result of experiment and scientific observation have extended through ages, religions seem to be the outcome of abstract reasoning. Work, useful and accumulative, with recuperation aiming at high is its chief and ever-recurring. Thus we are inspired both by and Science to do our utmost in increasing the performance of the most important of human problems now specifically consider.

## THE SOURCE OF HUMAN ENERGY THREE WAYS OF DRAWING FROM THE SUN.

First let us ask: Whence comes motive power? What is the ocean drives all? We see the ocean the rivers flow, the wind, rain, heat on our windows, the trains come and go; we hear the rattling of the voices from the feel, smell, and taste; and we this. And all this movement, feeling of the mighty ocean to that common cause. All this energy from one single center, one source, the sun. The sun is the spring all. The sun maintains all human supplies all human energy. And we have now found to the above: To increase the force of human movement means to turn



speculations and theories, considering man as a mass moved by a force, viewing his inexplicable movement in the light of a mechanical one, and applying the simple principles of mechanics to the analysis of the same until I arrived at these solutions, only to realize that they were taught to me in my early childhood. These three words sound the key-notes of the Christian religion. Their scientific meaning and purpose are now clear to me: food to increase the mass, peace to diminish the retarding force, and work to increase the force accelerating human movement. These are the only three solutions which are possible of that great problem, and all of them have one object, one end, namely, to increase human energy. When we recognize this, we cannot help wondering how profoundly wise and scientific and how immensely practical the Christian religion is, and in what a marked contrast it stands in this respect to other religions. It is unmistakably the result of practical experiment and scientific observation which have extended through ages, while other religions seem to be the outcome of merely abstract reasoning. Work, untiring effort, useful and accumulative, with periods of rest and recuperation aiming at higher efficiency, is its chief and ever-recurring command. Thus we are inspired both by Christianity and Science to do our utmost toward increasing the performance of mankind. This most important of human problems I shall now specifically consider.

#### THE SOURCE OF HUMAN ENERGY—THE THREE WAYS OF DRAWING ENERGY FROM THE SUN.

FIRST let us ask: Whence comes all the motive power? What is the spring that drives all? We see the ocean rise and fall, the rivers flow, the wind, rain, hail, and snow beat on our windows, the trains and steamers come and go; we hear the rattling noise of carriages, the voices from the street; we feel, smell, and taste; and we think of all this. And all this movement, from the surging of the mighty ocean to that subtle movement concerned in our thought, has but one common cause. All this energy emanates from one single center, one single source—the sun. The sun is the spring that drives all. The sun maintains all human life and supplies all human energy. Another answer we have now found to the above great question: To increase the force accelerating human movement means to turn to the uses

of man more of the sun's energy. We honor and revere those great men of bygone times whose names are linked with immortal achievements, who have proved themselves benefactors of humanity—the religious reformer with his wise maxims of life, the philosopher with his deep truths, the mathematician with his formulae, the physicist with his laws, the discoverer with his principles and secrets wrested from nature, the artist with his forms of the beautiful; but who honors him, the greatest of all,—who can tell the name of him,—who first turned to use the sun's energy to save the effort of a weak fellow-creature? That was man's first act of scientific philanthropy, and its consequences have been incalculable.

From the very beginning three ways of drawing energy from the sun were open to man. The savage, when he warmed his frozen limbs at a fire kindled in some way, availed himself of the energy of the sun stored in the burning material. When he carried a bundle of branches to his cave and burned them there, he made use of the sun's stored energy transported from one to another locality. When he set sail to his canoe, he utilized the energy of the sun supplied to the atmosphere or ambient medium. There can be no doubt that the first is the oldest way. A fire, found accidentally, taught the savage to appreciate its beneficial heat. He then very likely conceived the idea of carrying the glowing embers to his abode. Finally he learned to use the force of a swift current of water or air. It is characteristic of modern development that progress has been effected in the same order. The utilization of the energy stored in wood or coal, or, generally speaking, fuel, led to the steam-engine. Next a great stride in advance was made in energy-transportation by the use of electricity, which permitted the transfer of energy from one locality to another without transporting the material. But as to the utilization of the energy of the ambient medium, no radical step forward has as yet been made known.

The ultimate results of development in these three directions are: first, the burning of coal by a cold process in a battery; second, the efficient utilization of the energy of the ambient medium; and, third, the transmission without wires of electrical energy to any distance. In whatever way these results may be arrived at, their practical application will necessarily involve an extensive use of iron, and this invaluable metal will undoubtedly be an essential element in the further de-



velopment along these three lines. If we succeed in burning coal by a cold process and thus obtaining electrical energy in an efficient and inexpensive manner, we shall require in many practical uses of this energy electric motors—that is, iron. If we are successful in deriving energy from the ambient medium, we shall need, both in the obtainment and utilization of the energy, machinery—again, iron. If we realize the transmission of electrical energy without wires on an industrial scale, we shall be compelled to use extensively electric generators—once more, iron. Whatever we may do, iron will probably be the chief means of accomplishment in the near future, possibly more so than in the past. How long its reign will last is difficult to tell, for even now aluminium is looming up as a threatening competitor. But for the time being, next to providing new resources of energy, it is of the greatest importance to make improvements in the manufacture and utilization of iron. Great advances are possible in these latter directions, which, if brought about, would enormously increase the useful performance of mankind.

GREAT POSSIBILITIES OFFERED BY IRON FOR INCREASING HUMAN PERFORMANCE—ENORMOUS WASTE IN IRON MANUFACTURE.

IRON is by far the most important factor in modern progress. It contributes more than any other industrial product to the force accelerating human movement. So general is the use of this metal, and so intimately is it connected with all that concerns our life, that it has become as indispensable to us as the very air we breathe. Its name is synonymous with usefulness. But, however great the influence of iron may be on the present human development, it does not add to the force urging man onward nearly as much as it might. First of all, its manufacture as now carried on is connected with an appalling waste of fuel—that is, waste of energy. Then, again, only a part of all the iron produced is applied for useful purposes. A good part of it goes to create frictional resistances, while still another large part is the means of developing negative forces greatly retarding human movement. Thus the negative force of war is almost wholly represented in iron. It is impossible to estimate with any degree of accuracy the magnitude of this greatest of all retarding forces, but it is certainly very considerable. If the present positive impelling force due to all useful applications

of iron be represented by ten, for instance, I should not think it exaggeration to estimate the negative force of war, with due consideration of all its retarding influences and results, at, say, six. On the basis of this estimate the effective impelling force of iron in the positive direction would be measured by the difference of these two numbers, which is four. But if, through the establishment of universal peace, the manufacture of war machinery should cease, and all struggle for supremacy between nations should be turned into healthful, ever active and productive commercial competition, then the positive impelling force due to iron would be measured by the sum of those two numbers, which is sixteen—that is, this force would have four times its present value. This example is, of course, merely intended to give an idea of the immense increase in the performance of mankind which would result from a radical reform of the iron industries supplying the implements of warfare.

A similar inestimable advantage in the saving of energy available to man would be secured by obviating the great waste of coal which is inseparably connected with the present methods of manufacturing iron. In some countries, as in Great Britain, the hurtful effects of this squandering of fuel are beginning to be felt. The price of coal is constantly rising, and the poor are made to suffer more and more. Though we are still far from the dreaded "exhaustion of the coal-fields," philanthropy commands us to invent novel methods of manufacturing iron, which will not involve such barbarous waste of this valuable material from which we derive at present most of our energy. It is our duty to coming generations to leave this store of energy intact for them, or at least not to touch it until we shall have perfected processes for burning coal more efficiently. Those who are to come after us will need fuel more than we do. We should be able to manufacture the iron we require by using the sun's energy, without wasting any coal at all. As an effort to this end the idea of smelting iron ores by electric currents obtained from the energy of falling water has naturally suggested itself to many. I have myself spent much time in endeavoring to evolve such a practical process, which would enable iron to be manufactured at small cost. After a prolonged investigation of the subject, finding that it was unprofitable to use the currents generated directly for smelting the ore, I devised a method which is far more economical.

THE ECONOMIC PRODUCTION OF IRON BY A NEW PROCESS.

THE industrial project, as I outlined six years ago, contemplated the employment of the electric current for smelting the ore, but for the water, as a preliminary step, the cost of the plant, I propose to rate the currents in exceptionally simple dynamos, which I design for sole purpose. The hydrogen liberated by electrolytic decomposition was to be recombined with oxygen, not from which it was separated, but of the atmosphere. Thus very little total electrical energy used up in the position of the water would be required in the form of heat resulting from the combination of the hydrogen. This heat, applied to the smelting of the oxygen gained as a by-product in the position of the water I intended certain other industrial purposes would probably yield good financial results, inasmuch as this is the cheapest means of obtaining this gas in large quantities. In the event, it could be employed to burn refuse, cheap hydrocarbon, or the most inferior quality which could be burned in air or be otherwise utilized, and thus again a considerable amount of heat would be made available in the smelting of the ore. To increase the economy of the process I contemplated, using an arrangement of the hot metal and the products of the furnace, coming out of the furnace, and up their heat upon the cold ore in the furnace, so that comparatively little of the heat-energy would be lost in smelting. I calculated that probably ten thousand pounds of iron could be produced per horse-power per annum by this process, with losses which are unavoidable, the quantity being about half of that actually obtainable. Relying on this and on practical data with reference to certain kind of sand ore existing in the region of the Great Lakes, I found that in some localities iron could be manufactured in this manner cheaper than by any of the adopted methods. The oxygen obtained from the more surplus being used for smelting the ore, as



## THE PROBLEM OF INCREASING HUMAN ENERGY.

195

### ECONOMICAL PRODUCTION OF IRON BY A NEW PROCESS.

THE industrial project, as I worked it out six years ago, contemplated the employment of the electric currents derived from the energy of a waterfall, not directly for smelting the ore, but for decomposing water, as a preliminary step. To lessen the cost of the plant, I proposed to generate the currents in exceptionally cheap and simple dynamos, which I designed for this sole purpose. The hydrogen liberated in the electrolytic decomposition was to be burned or recombined with oxygen, not with that from which it was separated, but with that of the atmosphere. Thus very nearly the total electrical energy used up in the decomposition of the water would be recovered in the form of heat resulting from the recombination of the hydrogen. This heat was to be applied to the smelting of the ore. The oxygen gained as a by-product in the decomposition of the water I intended to use for certain other industrial purposes, which would probably yield good financial returns, inasmuch as this is the cheapest way of obtaining this gas in large quantities. In any event, it could be employed to burn all kinds of refuse, cheap hydrocarbon, or coal of the most inferior quality which could not be burned in air or be otherwise utilized to advantage, and thus again a considerable amount of heat would be made available for the smelting of the ore. To increase the economy of the process I contemplated, furthermore, using an arrangement such that the hot metal and the products of combustion, coming out of the furnace, would give up their heat upon the cold ore going into the furnace, so that comparatively little of the heat-energy would be lost in the smelting. I calculated that probably forty thousand pounds of iron could be produced per horse-power per annum by this method. Liberal allowances were made for those losses which are unavoidable, the above quantity being about half of that theoretically obtainable. Relying on this estimate and on practical data with reference to a certain kind of sand ore existing in abundance in the region of the Great Lakes, including cost of transportation and labor, I found that in some localities iron could be manufactured in this manner cheaper than by any of the adopted methods. This result would be attained all the more surely if the oxygen obtained from the water, instead of being used for smelting the ore, as assumed,

should be more profitably employed. Any new demand for this gas would secure a higher revenue from the plant, thus cheapening the iron. This project was advanced merely in the interest of industry. Some day, I hope, a beautiful industrial butterfly will come out of the dusty and shriveled chrysalis.

The production of iron from sand ores by a process of magnetic separation is highly commendable in principle, since it involves no waste of coal; but the usefulness of this method is largely reduced by the necessity of melting the iron afterward. As to the crushing of iron ore, I would consider it rational only if done by water-power, or by energy otherwise obtained without consumption of fuel. An electrolytic cold process, which would make it possible to extract iron cheaply, and also to mold it into the required forms without any fuel consumption, would, in my opinion, be a very great advance in iron manufacture. In common with some other metals, iron has so far resisted electrolytic treatment, but there can be no doubt that such a cold process will ultimately replace in metallurgy the present crude method of casting, and thus obviate the enormous waste of fuel necessitated by the repeated heating of metal in the foundries.

Up to a few decades ago the usefulness of iron was based almost wholly on its remarkable mechanical properties, but since the advent of the commercial dynamo and electric motor its value to mankind has been greatly increased by its unique magnetic qualities. As regards the latter, iron has been greatly improved of late. The signal progress began about thirteen years ago, when I discovered that in using soft Bessemer steel instead of wrought iron, as then customary, in an alternating motor, the performance of the machine was doubled. I brought this fact to the attention of Mr. Albert Schmid, to whose untiring efforts and ability is largely due the supremacy of American electrical machinery, and who was then superintendent of an industrial corporation engaged in this field. Following my suggestion, he constructed transformers of steel, and they showed the same marked improvement. The investigation was then systematically continued under Mr. Schmid's guidance, the impurities being gradually eliminated from the "steel" (which was only such in name, for in reality it was pure soft iron), and soon a product resulted which admitted of little further improvement.



THE COMING AGE OF ALUMINIUM—DOOM OF  
THE COPPER INDUSTRY—THE GREAT CIVILIZING  
POTENCY OF THE NEW METAL.

WITH the advances made in iron of late years we have arrived virtually at the limits of improvement. We cannot hope to increase very materially its tensile strength, elasticity, hardness, or malleability, nor can we expect to make it much better as regards its magnetic qualities. More recently a notable gain was secured by the mixture of a small percentage of nickel with the iron, but there is not much room for further advance in this direction. New discoveries may be expected, but they cannot greatly add to the valuable properties of the metal, though they may considerably reduce the cost of manufacture. The immediate future of iron is assured by its cheapness and its unrivaled mechanical and magnetic qualities. These are such that no other product can compete with it now. But there can be no doubt that, at a time not very distant, iron, in many of its now uncontested domains, will have to pass the scepter to another: the coming age will be the age of aluminium. It is only seventy years since this wonderful metal was discovered by Woehler, and the aluminium industry, scarcely forty years old, commands already the attention of the entire world. Such rapid growth has not been recorded in the history of civilization before. Not long ago aluminium was sold at the fanciful price of thirty or forty dollars per pound; to-day it can be had in any desired amount for as many cents. What is more, the time is not far off when this price, too, will be considerably reduced by adopting in its manufacture a method similar to that proposed by aluminium requires for fusion only about seventy per cent. of the heat needed for melting a pound of iron, and inasmuch as the weight is only about one third of that of iron, a volume of aluminium four times that of iron could be obtained from a given amount of heat-energy. But a cold electrolytic process of manufacture is the ideal solution, and on this I have placed my hope.

The absolutely unavoidable consequence of the advance of the aluminium industry will be the annihilation of the copper industry. They cannot exist and prosper together, and the latter is doomed beyond hope of recovery. Even now it is cheaper to convey an electric current through aluminium wires than through copper wires; aluminium castings cost less, and in many domestic and other uses copper has no chance of successfully competing. A further material reduction of the price of aluminium cannot but be fatal to copper. But the progress of the former will not go on unchecked, for, as it ever happens in such cases, the larger industry will absorb the smaller one: the giant copper interests will control the pygmy aluminium interests, and the slow-pacing copper will reduce the lively gait of aluminium. This will only delay, not avoid, the impending catastrophe.

Aluminium, however, will not stop at downing copper. Before many years have passed it will be engaged in a fierce struggle with iron, and in the latter it will find an adversary not easy to conquer. The issue of the contest will largely depend on whether iron shall be indispensable in electric machinery. This the future alone can decide. The magnetism as exhibited in iron is an isolated phenomenon in nature. What it is that makes this metal behave so radically different from all other materials in this respect has not yet been ascertained, though many theories have been suggested. As regards magnetism, the molecules of the various bodies behave like hollow beams partly filled with a heavy fluid and balanced in the middle in the manner of a see-saw. Evidently some disturbing influence exists in nature which causes each molecule, like such a beam, to tilt either one or the other way. If the molecules are tilted one way, the body is magnetic; if they are tilted the other way, the body is non-magnetic; but both positions are stable, as they would be in the case of the hollow beam, owing to the rushing of the fluid to the lower end. Now, the wonderful thing is that the molecules of all known bodies went one way, while those of iron went the other way. This metal, it would seem, has an origin entirely different from that of the rest of the globe. It is highly improbable that we shall discover some other and cheaper material which will equal or surpass iron in magnetic qualities.

Unless we should make a radical departure in the character of the electric currents employed, iron will be indispensable. Yet

THE PROBLEM

the advantages it offers are so long as we use feeble magnets, far superior to any other if we find ways of producing without it. In fact, I have already found better results with electric transformers in which employed, and which are forming ten times as much of weight as those with iron. attained by using electric current, high rate of vibration, produced instead of the ordinary ways, instead of the ordinary employed in the industries. I succeeded in operating electric iron by such rapidly vibrating the results, so far, have been obtained with ordinary motor of iron, although theoretical should be capable of performing more work per unit of weight. But the seemingly insurmountable difficulties which are now in the end, and the done away with, and all electrical will be manufactured of aluminium, at prices ridiculous would be a severe, if not a iron. In many other branches as ship-building, or wherever structure is required, the new metal will be much quicker uses it is eminently suitable, supersede iron sooner or later probable that in the course of be able to give it many of the which make iron so valuable.

While it is impossible to industrial revolution will be come it will be the chief means human performance. It has in capacities greater by far than other metal. I should estimate potency at fully one hundred iron. This estimate, though it is not at all exaggerated. Firmly must remember that there is the uses of man. This in itself possibilities. Then, again, the much more easily workable, which takes of the character of its value. In many of its properties gives it additional worth conductivity, which, for a greater than that of a be alone sufficient.



the advantages it offers are only apparent. So long as we use feeble magnetic forces it is by far superior to any other material; but if we find ways of producing great magnetic forces, then better results will be obtainable without it. In fact, I have already produced electric transformers in which no iron is employed, and which are capable of performing ten times as much work per pound of weight as those with iron. This result is attained by using electric currents of a very high rate of vibration, produced in novel ways, instead of the ordinary currents now employed in the industries. I have also succeeded in operating electric motors without iron by such rapidly vibrating currents, but the results, so far, have been inferior to those obtained with ordinary motors constructed of iron, although theoretically the former should be capable of performing incomparably more work per unit of weight than the latter. But the seemingly insuperable difficulties which are now in the way may be overcome in the end, and then iron will be done away with, and all electric machinery will be manufactured of aluminium, in all probability, at prices ridiculously low. This would be a severe, if not a fatal, blow to iron. In many other branches of industry, as ship-building, or wherever lightness of structure is required, the progress of the new metal will be much quicker. For such uses it is eminently suitable, and is sure to supersede iron sooner or later. It is highly probable that in the course of time we shall be able to give it many of those qualities which make iron so valuable.

While it is impossible to tell when this industrial revolution will be consummated, there can be no doubt that the future belongs to aluminium, and that in times to come it will be the chief means of increasing human performance. It has in this respect capacities greater by far than those of any other metal. I should estimate its civilizing potency at fully one hundred times that of iron. This estimate, though it may astonish, is not at all exaggerated. First of all, we must remember that there is thirty times as much aluminium as iron in bulk, available for the uses of man. This in itself offers great possibilities. Then, again, the new metal is much more easily workable, which adds to its value. In many of its properties it partakes of the character of a precious metal, which gives it additional worth. Its electric conductivity, which, for a given weight, is greater than that of any other metal, would be alone sufficient to make it one of the most

important factors in future human progress. Its extreme lightness makes it far more easy to transport the objects manufactured. By virtue of this property it will revolutionize naval construction, and in facilitating transport and travel it will add enormously to the useful performance of mankind. But its greatest civilizing potency will be, I believe, in aerial travel, which is sure to be brought about by means of it. Telegraphic instruments will slowly enlighten the barbarian. Electric motors and lamps will do it more quickly, but quicker than anything else the flying-machine will do it. By rendering travel ideally easy it will be the best means for unifying the heterogeneous elements of humanity. As the first step toward this realization we should produce a lighter storage-battery or get more energy from coal.

#### EFFORTS TOWARD OBTAINING MORE ENERGY FROM COAL—THE ELECTRIC TRANSMISSION—THE GAS-ENGINE—THE COLD-COAL BATTERY.

I REMEMBER that at one time I considered the production of electricity by burning coal in a battery as the greatest achievement toward advancing civilization, and I am surprised to find how much the continuous study of these subjects has modified my views. It now seems to me that to burn coal, however efficiently, in a battery would be a mere makeshift, a phase in the evolution toward something much more perfect. After all, in generating electricity in this manner, we should be destroying material, and this would be a barbarous process. We ought to be able to obtain the energy we need without consumption of material. But I am far from underrating the value of such an efficient method of burning fuel. At the present time most motive power comes from coal, and, either directly or by its products, it adds vastly to human energy. Unfortunately, in all the processes now adopted, the larger portion of the energy of the coal is uselessly dissipated. The best steam-engines utilize only a small part of the total energy. Even in gas-engines, in which, particularly of late, better results are obtainable, there is still a barbarous waste going on. In our electric-lighting systems we scarcely utilize one third of one per cent., and in lighting by gas a much smaller fraction, of the total energy of the coal. Considering the various uses of coal throughout the world, we certainly do not utilize more than two per cent. of its energy theoretically available. The man who should stop this senseless waste would be, a great







such positive methods as those which are available in the treatment of many physical problems. The result, if possible, will be arrived at through patient trying rather than through deduction or calculation. The time will soon come, however, when the chemist will be able to follow a course clearly mapped out beforehand, and when the process of his arriving at a desired result will be purely constructive. The cold-coal battery would give a great impetus to electrical development; it would lead very shortly to a practical flying-machine, and would enormously enhance the introduction of the automobile. But these and many other problems will be better solved, and in a more scientific manner, by a light-storage battery.

ENERGY FROM THE MEDIUM—THE WINDMILL  
AND THE SOLAR ENGINE—MOTIVE POWER  
FROM TERRESTRIAL HEAT—ELECTRICITY  
FROM NATURAL SOURCES.

BESIDES fuel, there is abundant material from which we might eventually derive power. An immense amount of energy is locked up in limestone, for instance, and machines can be driven by liberating the carbonic acid through sulphuric acid or otherwise. I once constructed such an engine, and it operated satisfactorily.

But, whatever our resources of primary energy may be in the future, we must, to be rational, obtain it without consumption of any material. Long ago I came to this conclusion, and to arrive at this result only two ways, as before indicated, appeared possible—either to turn to use the energy of the sun stored in the ambient medium, or to transmit, through the medium, the sun's energy to distant places from some locality where it was obtainable without consumption of material. At that time I at once rejected the latter method as entirely impracticable, and turned to examine the possibilities of the former.

It is difficult to believe, but it is, nevertheless, a fact, that since time immemorial man has had at his disposal a fairly good machine which has enabled him to utilize the energy of the ambient medium. This machine is the windmill. Contrary to popular belief, the power obtainable from wind is very considerable. Many a deluded inventor has spent years of his life in endeavoring to "harness the tides," and some have even proposed to compress air by tide- or wave-power for supplying energy, never understanding the signs of the old windmill on the hill, as it

sorrowfully waved its arms about and bade them stop. The fact is that a wave- or tide-motor would have, as a rule, but a small chance of competing commercially with the windmill, which is by far the better machine, allowing a much greater amount of energy to be obtained in a simpler way. Wind-power has been, in old times, of inestimable value to man, if for nothing else but for enabling him to cross the seas, and it is even now a very important factor in travel and transportation. But there are great limitations in this ideally simple method of utilizing the sun's energy. The machines are large for a given output, and the power is intermittent, thus necessitating the storage of energy and increasing the cost of the plant.

A far better way, however, to obtain power would be to avail ourselves of the sun's rays, which beat the earth incessantly and supply energy at a maximum rate of over four million horse-power per square mile. Although the average energy received per square mile in any locality during the year is only a small fraction of that amount, yet an inexhaustible source of power would be opened up by the discovery of some efficient method of utilizing the energy of the rays. The only rational way known to me at the time when I began the study of this subject was to employ some kind of heat- or thermodynamic engine, driven by a volatile fluid evaporated in a boiler by the heat of the rays. But closer investigation of this method, and calculation, showed that, notwithstanding the apparently vast amount of energy received from the sun's rays, only a small fraction of that energy could be actually utilized in this manner. Furthermore, the energy supplied through the sun's radiations is periodical, and the same limitations as in the use of the windmill I found to exist here also. After a long study of this mode of obtaining motive power from the sun, taking into account the necessarily large bulk of the boiler, the low efficiency of the heat-engine, the additional cost of storing the energy, and other drawbacks, I came to the conclusion that the "solar engine," a few instances excepted, could not be industrially exploited with success.

Another way of getting motive power from the medium without consuming any material would be to utilize the heat contained in the earth, the water, or the air for driving an engine. It is a well-known fact that the interior portions of the globe are very hot, the temperature rising, as observa-



The second fact which I have ascertained is that the upper air strata are permanently charged with electricity opposite to that of

It is possible, and even probable, that the forces such as magnetism or gravity driving machinery without using any means. Such realizations, though highly probable, are not impossible. An example will best convey an idea of what we can attain and what we can never attain. Imagine a disk of some homogeneous material turned perfectly true and arranged to turn in frictionless bearings on a horizontal shaft above the ground. This disk, being under the above conditions perfectly balanced, would rest in any position. Now, it is possible that we may learn how to make such a disk rotate continuously and perform such a feat by the force of gravity without any further effort on our part; but it is perfectly impossible for the disk to turn and to do so without any force from the outside. If it could do so, it would be what is designated scientifically as a "perpetuum mobile," a machine creating its own motive power. To make the disk rotate by the force of gravity we have only to invent a screen against this force. Such a screen we could prevent this force from acting on one half of the disk, and the rotation of the latter would follow. At present, we cannot deny such a possibility until we know exactly the nature of the force of gravity. Suppose that this force were due to a movement comparable to that of a stream of air passing from above toward the center of the earth. The effect of such a stream on both halves of the disk would be equal, and the latter would not rotate ordinarily. If one half should be guarded by a plate preventing the movement, then it would turn.

WHEN I began the investigation of the subject under consideration, and when the preceding or similar ideas presented themselves

THE PROBLEM was for the first time, though disappointed with a number mentioned, a survey of the utilizing the energy of the wind, nevertheless, that to me, a satisfactory practice and departure from the method to be made. The wind had their limitations in the engine driven by some new way obtainable. Some new way over which would enable energy. There was enough the medium, but only a small available for the operation the ways then known. Besides was obtainable only at a Clear, then, the problem some new method which would be both to utilize more of the medium and also to from the same at a more rapid rate.

I was vainly endeavoring of how this might be accomplished when I read some statements from Kelvin (then Sir William Thomson) meant virtually that it is impossible to cool a portion of the medium by the heat abstracted. This interested me intensely. Even being could do this very thing experiences of my early life related had convinced me being is only an automaton stated, a "self-acting engine" the conclusion that it was possible to construct a machine which would As the first step toward this received the following mechanical thermophile consisting of a of metal extending from the outer space beyond the atmosphere heat from below, conducted these metal bars, would cool the sea or the air, according of the lower parts of the bars, as is well known, would be circulating in these bars. The of the thermophile could now be an electric motor, and, the motor would run on, and, the below would be cooled down, the nature of the outer space. The inanimate engine which, to would be cooling a portion of below the temperature of the and operating by the heat.

VOL. LX.—24-25.



to me for the first time, though I was then unacquainted with a number of the facts mentioned, a survey of the various ways of utilizing the energy of the medium convinced me, nevertheless, that to arrive at a thoroughly satisfactory practical solution a radical departure from the methods then known had to be made. The windmill, the solar engine, the engine driven by terrestrial heat, had their limitations in the amount of power obtainable. Some new way had to be discovered which would enable us to get more energy. There was enough heat-energy in the medium, but only a small part of it was available for the operation of an engine in the ways then known. Besides, the energy was obtainable only at a very slow rate. Clearly, then, the problem was to discover some new method which would make it possible both to utilize more of the heat-energy of the medium and also to draw it away from the same at a more rapid rate.

I was vainly endeavoring to form an idea of how this might be accomplished, when I read some statements from Carnot and Lord Kelvin (then Sir William Thomson) which meant virtually that it is impossible for an inanimate mechanism or self-acting machine to cool a portion of the medium below the temperature of the surrounding, and operate by the heat abstracted. These statements interested me intensely. Evidently a living being could do this very thing, and since the experiences of my early life which I have related had convinced me that a living being is only an automaton, or, otherwise stated, a "self-acting engine," I came to the conclusion that it was possible to construct a machine which would do the same. As the first step toward this realization I conceived the following mechanism. Imagine a thermopile consisting of a number of bars of metal extending from the earth to the outer space beyond the atmosphere. The heat from below, conducted upward along these metal bars, would cool the earth or the sea or the air, according to the location of the lower parts of the bars, and the result, as is well known, would be an electric current circulating in these bars. The two terminals of the thermopile could now be joined through an electric motor, and, theoretically, this motor would run on and on, until the media below would be cooled down to the temperature of the outer space. This would be an inanimate engine which, to all evidence, would be cooling a portion of the medium below the temperature of the surrounding, and operating by the heat abstracted.

VOL. LX.—24-25.

But was it not possible to realize a similar condition without necessarily going to a height? Conceive, for the sake of illustra-

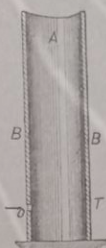


DIAGRAM b. OBTAINING ENERGY FROM THE AMBIENT MEDIUM.

A, medium with little energy; B, B, ambient medium with much energy; O, path of the energy.

tion, an inclosure *T*, as illustrated in diagram *b*, such that energy could not be transferred across it except through a channel or path *O*, and that, by some means or other, in this inclosure a medium were maintained which would have little energy, and that on the outer side of the same there would be the ordinary ambient medium with much energy. Under these assumptions the energy would flow through the path *O*, as indicated by the arrow, and might then be converted on its passage into some other form of energy. The question was, Could such a condition be attained? Could we produce artificially such a "sink" for the energy of the ambient medium to flow in? Suppose that an extremely low temperature could be maintained by some process in a given space; the surrounding medium would then be compelled to give off heat, which could be converted into mechanical or other form of energy, and utilized. By realizing such a plan, we should be enabled to get at any point of the globe a continuous supply of energy, day and night. More than this, reasoning in the abstract, it would seem possible to cause a quick circulation of the medium, and thus draw the energy at a very rapid rate.

Here, then, was an idea which, if realizable, afforded a happy solution of the problem of getting energy from the medium. But was it realizable? I convinced myself that it was so in a number of ways, of which one is the following. As regards heat, we are at a high level, which may be represented by the surface of a mountain lake considerably above the sea, the level of which may mark the absolute zero of temperature existing in the interstellar space. Heat, like water, flows



from high to low level, and, consequently, just as we can let the water of the lake run down to the sea, so we are able to let heat from the earth's surface travel up into the cold region above. Heat, like water, can perform work in flowing down, and if we had any doubt as to whether we could derive energy from the medium by means of a thermopile, as before described, it would be dispelled by this analogue. But can we produce cold in a given portion of the space and cause the heat to flow in continually? To create such a "sink," or "cold hole," as we might say, in the medium, would be equivalent to producing in the lake a space either empty or filled with something much lighter than water. This we could do by placing in the lake a tank, and pumping all the water out of the latter. We know, then, that the water, if allowed to flow back into the tank, would, theoretically, be able to perform exactly the same amount of work which was used in pumping it out, but not a bit more. Consequently nothing could be gained in this double operation of first raising the water and then letting it fall down. This would mean that it is impossible to create such a sink in the medium. But let us reflect a moment. Heat, though following certain general laws of mechanics, like a fluid, is not such; it is energy which may be converted into other forms of energy as it passes from a high to a low level. To make our mechanical analogy complete and true, we must, therefore, assume that the water, in its passage into the tank, is converted into something else, which may be taken out of it without using any, or by using very little, power. For example, if heat be represented in this analogue by the water of the lake, the oxygen and hydrogen composing the water may illustrate other forms of energy into which the heat is transformed in passing from hot to cold. If the process of heat-transformation were absolutely perfect, no heat at all would arrive at the low level, since all of it would be converted into other forms of energy. Corresponding to this ideal case, all the water flowing into the tank would be decomposed into oxygen and hydrogen before reaching the bottom, and the result would be that water would continually flow in, and yet the tank would remain entirely empty, the gases formed escaping. We would thus produce, by expending initially a certain amount of work to create a sink for the heat or, respectively, the water to flow in, a condition enabling us to get any amount of energy without further effort.

This would be an ideal way of obtaining motive power. We do not know of any such absolutely perfect process of heat-conversion, and consequently some heat will generally reach the low level, which means, say, in our mechanical analogue, that some water will arrive at the bottom of the tank, and a gradual and slow filling of the latter will take place, necessitating continuous pumping out. But evidently there will be less to pump out than flows in, or, in other words, less energy will be needed to maintain the initial condition than is developed by the fall, and this is to say that some energy will be gained from the medium. What is not converted in flowing down can just be raised up with its own energy, and what is converted is clear gain. Thus the virtue of the principle I have discovered resides wholly in the conversion of the energy on the downward flow.

#### FIRST EFFORTS TO PRODUCE THE SELF-ACTING ENGINE—THE MECHANICAL OSCILLATOR—WORK OF DEWAR AND LINDE—LIQUID AIR.

HAVING recognized this truth, I began to devise means for carrying out my idea, and, after long thought, I finally conceived a combination of apparatus which should make possible the obtaining of power from the medium by a process of continuous cooling of atmospheric air. This apparatus, by continually transforming heat into mechanical work, tended to become colder and colder, and if it only were practicable to reach a very low temperature in this manner, then a sink for the heat could be produced, and energy could be derived from the medium. This seemed to be contrary to the statements of Carnot and Lord Kelvin before referred to, but I concluded from the theory of the process that such a result could be attained. This conclusion I reached, I think, in the latter part of 1883, when I was in Paris, and it was at a time when my mind was being more and more dominated by an invention which I had evolved during the preceding year, and which has since become known under the name of the "rotating magnetic field." During the few years which followed I elaborated further the plan I had imagined, and studied the working conditions, but made little headway. The commercial introduction in this country of the invention before referred to required most of my energies until 1889, when I again took up the idea of the self-acting machine. A closer in-

THE PROBLEM OF  
 The principles involved in the conversion of heat into mechanical energy, now showed that the result could not be reached in a manner by ordinary machinery, as in the beginning expected. This led to a more step, to the study of a type of machine generally designated as "turbine," which seemed to offer better chances of realization of the idea. Soon I found, however, that the turbine, too, was unsuited for the purpose, and I concluded that my conclusions showed that if an engine of a peculiar kind could be brought into existence, it would be of a high degree of perfection, and I resolved to devote myself to the study of such an engine, with the development of which was connected the primary object of which was to produce the greatest economy of transformation of heat into mechanical energy. A characteristic feature of the engine was not a work-performing piston was not connected with anything else, but was perfect in its operation with an enormous rate. The difficulties encountered in the construction of this engine were greater than anticipated, and I made slow progress. The work was continued until early in 1890, when I went to London, where I saw Dewar's admirable experiments with liquefied gases. Others had liquefied gases by means of the apparatus of Pictet and Oersted, but Dewar had made more creditable early experiments in this line, and there was such a vigor about his work that even the old appeared experiments showed, though in a different manner from that I had imagined, that it was possible to reach a very low temperature by transforming heat into mechanical energy. I returned, deeply impressed with the results seen, and more than ever convinced that the plan was practicable. The work was interrupted was taken up anew, and in a fair state of perfection, which I have named "the mechanical oscillator." In this machine I succeeded in producing so rapid motion of the piston that shafts of tough material were torn asunder. By combining the machine with a dynamo of special design, I produced a highly efficient electric motor, the measurements and the unvarying rate of oscillation of the machine, named "mechanical oscillator," before the Electrical Congress at the World's Fair in Chicago, the summer of 1893.



investigation of the principles involved, and calculation, now showed that the result I aimed at could not be reached in a practical manner by ordinary machinery, as I had in the beginning expected. This led me, as a next step, to the study of a type of engine generally designated as "turbine," which at first seemed to offer better chances for a realization of the idea. Soon I found, however, that the turbine, too, was unsuitable. But my conclusions showed that if an engine of a peculiar kind could be brought to a high degree of perfection, the plan I had conceived was realizable, and I resolved to proceed with the development of such an engine, the primary object of which was to secure the greatest economy of transformation of heat into mechanical energy. A characteristic feature of the engine was that the work-performing piston was not connected with anything else, but was perfectly free to vibrate at an enormous rate. The mechanical difficulties encountered in the construction of this engine were greater than I had anticipated, and I made slow progress. This work was continued until early in 1892, when I went to London, where I saw Professor Dewar's admirable experiments with liquefied gases. Others had liquefied gases before, and notably Ozlewski and Pictet had performed creditable early experiments in this line, but there was such a vigor about the work of Dewar that even the old appeared new. His experiments showed, though in a way different from that I had imagined, that it was possible to reach a very low temperature by transforming heat into mechanical work, and I returned, deeply impressed with what I had seen, and more than ever convinced that my plan was practicable. The work temporarily interrupted was taken up anew, and soon I had in a fair state of perfection the engine which I have named "the mechanical oscillator." In this machine I succeeded in doing away with all packings, valves, and lubrication, and in producing so rapid a vibration of the piston that shafts of tough steel, fastened to the same and vibrated longitudinally, were torn asunder. By combining this engine with a dynamo of special design I produced a highly efficient electrical generator, invaluable in measurements and determinations of physical quantities on account of the unvarying rate of oscillation obtainable by its means. I exhibited several types of this machine, named "mechanical and electrical oscillator," before the Electrical Congress at the World's Fair in Chicago during the summer of 1893, in a lecture which, on

account of other pressing work, I was unable to prepare for publication. On that occasion I exposed the principles of the mechanical oscillator, but the original purpose of this machine is explained here for the first time.

In the process, as I had primarily conceived it, for the utilization of the energy of the ambient medium, there were five essential elements in combination, and each of these had to be newly designed and perfected, as no such machines existed. The mechanical oscillator was the first element of this combination, and having perfected this, I turned to the next, which was an air-compressor of a design in certain respects resembling that of the mechanical oscillator. Similar difficulties in the construction were again encountered, but the work was pushed vigorously, and at the close of 1894 I had completed these two elements of the combination, and thus produced an apparatus for compressing air, virtually to any desired pressure, incomparably simpler, smaller, and more efficient than the ordinary. I was just beginning work on the third element, which together with the first two would give a refrigerating machine of exceptional efficiency and simplicity, when a misfortune befell me in the burning of my laboratory, which crippled my labors and delayed me. Shortly afterward Dr. Carl Linde announced the liquefaction of air by a self-cooling process, demonstrating that it was practicable to proceed with the cooling until liquefaction of the air took place. This was the only experimental proof which I was still wanting that energy was obtainable from the medium in the manner contemplated by me.

The liquefaction of air by a self-cooling process was not, as popularly believed, an accidental discovery, but a scientific result which could not have been delayed much longer, and which, in all probability, could not have escaped Dewar. This fascinating advance, I believe, is largely due to the powerful work of this great Scotchman. Nevertheless, Linde's is an immortal achievement. The manufacture of liquid air has been carried on for four years in Germany, on a scale much larger than in any other country, and this strange product has been applied for a variety of purposes. Much was expected of it in the beginning, but so far it has been an industrial ignis fatuus. By the use of such machinery as I am perfecting, its cost will probably be greatly lessened, but even then its commercial success will be ques-

EFFORTS TO PRODUCE THE SELF-  
ENGINE—THE MECHANICAL OSCIL-  
WORK OF DEWAR AND LINDE  
AIR.

recognized this truth, I began means for carrying out my long thought, I finally conceived of an apparatus which should make the obtaining of power from a process of continuous condensation of atmospheric air. This apparatus, by transforming heat into mechanical work, ended to become colder and colder, and were practicable to reach a very low temperature in this manner, then a small amount of heat could be produced, and energy derived from the medium. This was contrary to the statements of Lord Kelvin before me, but I concluded from the results of my experiments that such a result could be reached. I reached this conclusion I reached, I think, in the autumn of 1883, when I was in Paris at a time when my mind was dominated by an interest in the problem of the "rotating magnet," which has since become known as the "Wiedemann effect." I had been further the plan I had conceived of the working conditions of this machine. The commercial success of this country of the invention had required most of my attention, when I again took up the subject of the self-acting machine. A closer in-



tionable. When used as a refrigerant it is uneconomical, as its temperature is unnecessarily low. It is as expensive to maintain a body at a very low temperature as it is to keep it very hot; it takes coal to keep air cold. In oxygen manufacture it cannot yet compete with the electrolytic method. For use as an explosive it is unsuitable, because its low temperature again condemns it to a small efficiency, and for motive-power purposes its cost is still by far too high. It is of interest to note, however, that in driving an engine by liquid air a certain amount of energy may be gained from the engine, or, stated otherwise, from the ambient medium which keeps the engine warm, each two hundred pounds of iron-casting of the latter contributing energy at the rate of about one effective horse-power during one hour. But this gain of the consumer is offset by an equal loss of the producer.

Much of this task on which I have labored so long remains to be done. A number of mechanical details are still to be perfected and some difficulties of a different nature to be mastered, and I cannot hope to produce a self-acting machine deriving energy from the ambient medium for a long time yet, even if all my expectations should materialize. Many circumstances have occurred which have retarded my work of late, but for several reasons the delay was beneficial.

One of these reasons was that I had ample time to consider what the ultimate possibilities of this development might be. I worked for a long time fully convinced that the practical realization of this method of obtaining energy from the sun would be of incalculable industrial value, but the continued study of the subject revealed the fact that while it will be commercially profitable if my expectations are well founded, it will not be so to an extraordinary degree.

DISCOVERY OF UNEXPECTED PROPERTIES OF  
THE ATMOSPHERE—STRANGE EXPERIMENTS  
—TRANSMISSION OF ELECTRICAL ENERGY  
THROUGH ONE WIRE WITHOUT RETURN—  
TRANSMISSION THROUGH THE EARTH WITH-  
OUT ANY WIRE.

ANOTHER of these reasons was that I was led to recognize the transmission of electrical energy to any distance through the media as by far the best solution of the great problem of harnessing the sun's energy for the uses of man. For a long time I was convinced that such a transmission on an

industrial scale could never be realized, but a discovery which I made changed my view. I observed that under certain conditions the atmosphere, which is normally a high insulator, assumes conducting properties, and so becomes capable of conveying any amount of electrical energy. But the difficulties in the way of a practical utilization of this discovery for the purpose of transmitting electrical energy without wires were seemingly insuperable. Electrical pressures of many millions of volts had to be produced and handled; generating apparatus of a novel kind, capable of withstanding immense electrical stresses, had to be invented and perfected, and a complete safety against the dangers of the high-tension currents had to be attained in the system before its practical introduction could be even thought of. All this could not be done in a few weeks or months, or even years. The work required patience and constant application, but the improvements came, though slowly. Other valuable results were, however, arrived at in the course of this long-continued work, of which I shall endeavor to give a brief account, enumerating the chief advances as they were successively effected.

The discovery of the conducting properties of the air, though unexpected, was only a natural result of experiments in a special field which I had carried on for some years before. It was, I believe, during 1889 that certain possibilities offered by extremely rapid electrical oscillations determined me to design a number of special machines adapted for their investigation. Owing to the peculiar requirements, the construction of these machines was very difficult, and consumed much time and effort; but my work on them was generously rewarded, for I reached by their means several novel and important results. One of the earliest observations I made with these new machines was that electrical oscillations of an extremely high rate act in an extraordinary manner upon the human organism. Thus, for instance, I demonstrated that powerful electrical discharges of several hundred thousand volts, which at that time were considered absolutely deadly, could be passed through the body without inconvenience or hurtful consequences. These oscillations produced other specific physiological effects, which, upon my announcement, were eagerly taken up by skilled physicians and further investigated. This new field has proved itself fruitful beyond expectation, and in the few years which have passed since, it has been

THE PROBLEM

developed to such an extent as to become a legitimate and important branch of medical science. Many results, impossible at that time, are attainable with these oscillations, experiments undreamed of till recently performed with pleasure of a patient member with the discharge of a powerful electric current through my body. I passed the discharge through my body before a scientific society, the harmless nature of very rapidly changing electric currents, and I can still remember with much less apprehension the experiment, to transmit the electrical energy of the dynamo at Niagara—forty or fifty thousand volts, which were of such intensity when circulating through my body that they have melted wires which I have energized with such oscillations of heavy copper wire so powerfully, of metal, and even objects of resistance specifically greater than human tissue, brought close within the loop, were heated to temperature and melted, often with the result of an explosion, and yet into this which this terribly destructive force going on I have repeatedly thrived without feeling anything or experiencing any after-effects.

Another observation was that such oscillations light could be a novel and more economical method of illumination by vacuum-tube incandescence, and the necessity of renewing or incandescent filaments, and also with the use of wires in the construction of buildings. The efficiency of these oscillations in proportion to the rate of their oscillations, and its commercial value, dependent on the economic rates. In this direction I have gratifying success of late, and the introduction of this new system of illumination is not far off.

The investigations led to many other important observations and results, one of the most important of which was the demonstration of the practicability of supplying energy through one wire without a return. I was able to transmit



developed to such an extent that it now forms a legitimate and important department of medical science. Many results, thought impossible at that time, are now readily obtainable with these oscillations, and many experiments undreamed of then can now be readily performed by their means. I still remember with pleasure how, nine years ago, I passed the discharge of a powerful induction-coil through my body to demonstrate before a scientific society the comparative harmlessness of very rapidly vibrating electric currents, and I can still recall the astonishment of my audience. I would now undertake, with much less apprehension than I had in that experiment, to transmit through my body with such currents the entire electrical energy of the dynamos now working at Niagara—forty or fifty thousand horsepower. I have produced electrical oscillations which were of such intensity that when circulating through my arms and chest they have melted wires which joined my hands, and still I felt no inconvenience. I have energized with such oscillations a loop of heavy copper wire so powerfully that masses of metal, and even objects of an electrical resistance specifically greater than that of human tissue, brought close to or placed within the loop, were heated to a high temperature and melted, often with the violence of an explosion, and yet into this very space in which this terribly destructive turmoil was going on I have repeatedly thrust my head without feeling anything or experiencing injurious after-effects.

Another observation was that by means of such oscillations light could be produced in a novel and more economical manner, which promised to lead to an ideal system of electric illumination by vacuum-tubes, dispensing with the necessity of renewal of lamps or incandescent filaments, and possibly also with the use of wires in the interior of buildings. The efficiency of this light increases in proportion to the rate of the oscillations, and its commercial success is, therefore, dependent on the economical production of electrical vibrations of transcending rates. In this direction I have met with gratifying success of late, and the practical introduction of this new system of illumination is not far off.

The investigations led to many other valuable observations and results, one of the more important of which was the demonstration of the practicability of supplying electrical energy through one wire without return. At first I was able to transmit in this novel

manner only very small amounts of electrical energy, but in this line also my efforts have been rewarded with similar success.

The photograph shown in Fig. 2 (see p. 186) illustrates, as its title explains, an actual transmission of this kind effected with apparatus used in other experiments here described. To what a degree the appliances have been perfected since my first demonstrations early in 1891 before a scientific society, when my apparatus was barely capable of lighting one lamp (which result was considered wonderful), will appear when I state that I have now no difficulty in lighting in this manner four or five hundred lamps, and could light many more. In fact, there is no limit to the amount of energy which may in this way be supplied to operate any kind of electrical device.

After demonstrating the practicability of this method of transmission, the thought naturally occurred to me to use the earth as a conductor, thus dispensing with all wires. Whatever electricity may be, it is a fact that it behaves like an incompressible fluid, and the earth may be looked upon as an immense reservoir of electricity, which, I thought, could be disturbed effectively by a properly designed electrical machine. Accordingly, my next efforts were directed toward perfecting a special apparatus which would be highly effective in creating a disturbance of electricity in the earth. The progress in this new direction was necessarily very slow and the work discouraging, until I finally succeeded in perfecting a novel kind of transformer or induction-coil, particularly suited for this special purpose. That it is practicable, in this manner, not only to transmit minute amounts of electrical energy for operating delicate electrical devices, as I contemplated at first, but also electrical energy in appreciable quantities, will appear from an inspection of Fig. 4 (see p. 186), which illustrates an actual experiment of this kind performed with the same apparatus. The result obtained was all the more remarkable as the top end of the coil was not connected to a wire or plate for magnifying the effect.

#### "WIRELESS" TELEGRAPHY—THE SECRET OF TUNING—ERRORS IN THE HERTZIAN INVESTIGATIONS—A RECEIVER OF WONDERFUL SENSITIVENESS.

As the first valuable result of my experiments in this latter line a system of telegraphy without wires resulted, which I described in two



scientific lectures in February and March, 1893. It is mechanically illustrated in diagram *c*, the upper part of which shows the electrical arrangement as I described it then, while the lower part illustrates its mechanical analogue. The system is extremely simple in principle. Imagine two tuning-forks *F*, *F'*, one at the sending-station respectively, each having attached to its lower prong a minute piston *p*, fitting in a cylinder. Both the cylinders

communicate with a large reservoir *R*, with elastic walls, which is supposed to be closed and filled with a light and incompressible fluid. By striking repeatedly one of the prongs of the tuning-fork *F*, the small piston *p* below would be vibrated, and its vibrations, transmitted through the fluid, would reach the distant fork *F'*, which is "tuned" to the fork *F*, or, stated otherwise, of exactly the same note as the latter. The fork *F'* would now be set vibrating, and its vibration would be intensified by the continued action of the distant fork *F* until its upper prong, swinging far out, would make an electrical connection with a stationary contact *c'*, starting in this manner some electrical or other appliances which may be used for recording the signals. In this simple way messages could be exchanged between the two stations, a similar contact *c'* being provided for this purpose, close to the upper prong of the fork *F'*, so that the apparatus at each station could be employed in turn as receiver and transmitter.

The electrical system illustrated in the upper figure of diagram *c* is exactly the same in principle, the two wires or circuits *ESP* and *E'S'P'*, which extend vertically to a height, representing the two tuning-forks with the pistons attached to them. These circuits are connected with the ground by plates *E*, *E'*, and to two elevated metal sheets *P*, *P'*, which store electricity and thus magnify considerably the effect. The closed reservoir *R*, with elastic walls, is in this case replaced by the earth, and the fluid by electricity. Both of these circuits are "tuned" and operate just like the two tuning-forks. Instead of striking the fork *F* at the sending-station, electrical oscillations are produced in the vertical sending- or transmitting-wire *ESP*, as by the action of a source *S*, included in this wire, which

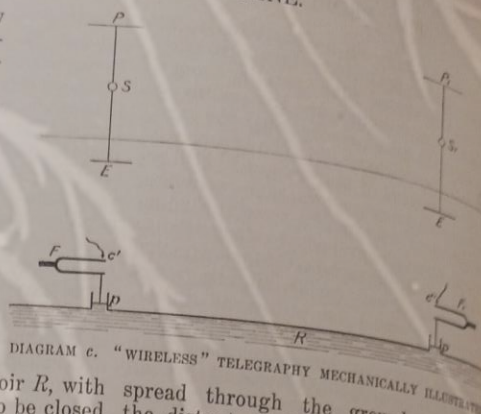


DIAGRAM *c*. "WIRELESS" TELEGRAPHY MECHANICALLY ILLUSTRATED.

spread through the ground and reach the distant vertical receiving-wire *E'S'P'* in the same. In the latter wire or circuit is included a sensitive device or receiver *S'*, which is thus set in action and made to operate a relay or other appliance. Each station of electrical oscillations *S* and a sensitive receiver *S'*, and a simple provision is made for using each of the two wires alternately to send and to receive the messages.

The exact attunement of the two circuits secures great advantages, and, in fact, it is essential in the practical use of the system. In this respect many popular errors exist, and, as a rule, in the technical reports on this subject circuits and appliances are described as affording these advantages when from their very nature it is evident that this is impossible. In order to attain the best results it is essential that the length of each wire or circuit, from the ground connection to the top, should be equal to one quarter of the wave-length of the electrical vibration in the wire, or else equal to that length multiplied by an odd number. Without the observation of this rule it is virtually impossible to prevent the interference and insure the privacy of messages. Therein lies the secret of tuning. To obtain the most satisfactory results it is, however, necessary to resort to electrical vibrations of low pitch. The Hertzian spark apparatus, used generally by experimenters, which produces oscillations of a very high rate, permits no effective tuning, and slight disturbances are sufficient to render an exchange of messages impracticable. But scientifically designed, efficient appliances allow nearly perfect adjustment. An experiment performed with the improved apparatus repeatedly referred to, and intended to convey an idea of this feature, is

## THE PROBLEM

illustrated in Fig. 5 (p. 187), is fully explained by its note. Since I described these air of telegraphy without wires I have had occasion to note that features and elements have the evident belief that the signals transmitted to consider by "Hertzian" radiations. T of many misapprehensions to investigations of the lamented given rise. About thirty-th Maxwell, following up a su experiment made by Faraday in an ideally simple theory which connected light, radiant heat phenomena, interpreting them all due to vibrations of a fluid of inconceivable tenuity ether. No experimental verification arrived at until Hertz, at the Helmholtz, undertook a series of this effect. Hertz proceeded ordinary ingenuity and insight, little energy to the perfection fashioned apparatus. The conclusion that he failed to observe the function which the air played in the phenomena, and which I subsequently Repeating his experiments a different results, I ventured to this oversight. The strength brought forward by Hertz in Maxwell's theory resided in the rate of the rates of vibration of the used. But I ascertained that not have obtained the rates he was getting. The vibrations of the apparatus he employed are, as slower, this being due to the pressure, which produces a dampening rapidly vibrating electric circuit tuning-fork. I have, however, since that time other causes and I have long ago ceased to his results as being an explanation of the poetical conception of the work of the physicist has acted as an impediment to contemporary electrical research has likewise, in a measure, by its paralyzed the scientific mind, and phenomenon which was discovered without fit the theory, and so very often has been unconsciously distorted. When I advanced this system phy, my mind was dominated by



illustrated in Fig. 5 (p. 187), which is sufficiently explained by its note.

Since I described these simple principles of telegraphy without wires I have had frequent occasion to note that the identical features and elements have been used, in the evident belief that the signals are being transmitted to considerable distances by "Hertzian" radiations. This is only one of many misapprehensions to which the investigations of the lamented physicist have given rise. About thirty-three years ago Maxwell, following up a suggestive experiment made by Faraday in 1845, evolved an ideally simple theory which intimately connected light, radiant heat, and electrical phenomena, interpreting them as being all due to vibrations of a hypothetical fluid of inconceivable tenuity, called the ether. No experimental verification was arrived at until Hertz, at the suggestion of Helmholtz, undertook a series of experiments to this effect. Hertz proceeded with extraordinary ingenuity and insight, but devoted little energy to the perfection of his old-fashioned apparatus. The consequence was that he failed to observe the important function which the air played in his experiments, and which I subsequently discovered. Repeating his experiments and reaching different results, I ventured to point out this oversight. The strength of the proofs brought forward by Hertz in support of Maxwell's theory resided in the correct estimate of the rates of vibration of the circuits he used. But I ascertained that he could not have obtained the rates he thought he was getting. The vibrations with identical apparatus he employed are, as a rule, much slower, this being due to the presence of air, which produces a dampening effect upon a rapidly vibrating electric circuit of high pressure, as a fluid does upon a vibrating tuning-fork. I have, however, discovered since that time other causes of error, and I have long ago ceased to look upon his results as being an experimental verification of the poetical conceptions of Maxwell. The work of the great German physicist has acted as an immense stimulus to contemporary electrical research, but it has likewise, in a measure, by its fascination, paralyzed the scientific mind, and thus hampered independent inquiry. Every new phenomenon which was discovered was made to fit the theory, and so very often the truth has been unconsciously distorted.

When I advanced this system of telegraphy, my mind was dominated by the idea of

effecting communication to any distance through the earth or enviroing medium, the practical consummation of which I considered of transcendent importance, chiefly on account of the moral effect which it could not fail to produce universally. As the first effort to this end I proposed, at that time, to employ relay-stations with tuned circuits, in the hope of making thus practicable signaling over vast distances, even with apparatus of very moderate power then at my command. I was confident, however, that with properly designed machinery signals could be transmitted to any point of the globe, no matter what the distance, without the necessity of using such intermediate stations. I gained this conviction through the discovery of a singular electrical phenomenon, which I described early in 1892, in lectures delivered before some scientific societies abroad, and which I have called a "rotating brush." This is a bundle of light which is formed, under certain conditions, in a vacuum-bulb, and which is of a sensitiveness to magnetic and electric influences bordering, so to speak, on the supernatural. This light-bundle is rapidly rotated by the earth's magnetism as many as twenty thousand times per second, the rotation in these parts being opposite to what it would be in the southern hemisphere, while in the region of the magnetic equator it should not rotate at all. In its most sensitive state, which is difficult to attain, it is responsive to electric or magnetic influences to an incredible degree. The mere stiffening of the muscles of the arm and consequent slight electrical change in the body of an observer standing at some distance from it, will perceptibly affect it. When in this highly sensitive state it is capable of indicating the slightest magnetic and electric changes taking place in the earth. The observation of this wonderful phenomenon impressed me strongly that communication at any distance could be easily effected by its means, provided that apparatus could be perfected capable of producing an electric or magnetic change of state, however small, in the terrestrial globe or enviroing medium.

DEVELOPMENT OF A NEW PRINCIPLE—THE ELECTRICAL OSCILLATOR—PRODUCTION OF IMMENSE ELECTRICAL MOVEMENTS—THE EARTH RESPONDS TO MAN—INTERPLANETARY COMMUNICATION NOW PROBABLE.

I RESOLVED to concentrate my efforts upon this venturesome task, though it involved

GRAPHY MECHANICALLY

h the ground and m  
rtical receiving-wire  
bonding electrical oscill  
the latter wire or circ  
itive device or receiver  
it in action and made to  
other appliance. Each  
provided both with a suc  
illations S and a semi  
a simple provision is m  
the two wires alternat  
ceive the messages.  
nement of the two circ  
antages, and, in fact, i  
actical use of the sym  
many popular errors an  
the technical reports o  
ls and appliances are b  
g these advantages wh  
ature it is evident th

In order to attain  
essential that the lengt  
t, from the ground  
should be equal to  
length of the electri  
e, or else equal to  
an odd number. Wh  
f this rule it is virtu  
t the interference  
messages. Therein  
To obtain the most  
however, necessary  
brations of low pres  
aratus, used gener  
ich produces oscil  
a, permits no effec  
urbances are suffic  
of messages improv  
ly designed, effec  
perfect adjustment  
ed with the improv  
ferred to, and in  
a of this feature



great sacrifice, for the difficulties to be mastered were such that I could hope to consummate it only after years of labor. It meant delay of other work to which I would have preferred to devote myself, but I gained the conviction that my energies could not be more usefully employed; for I recognized that an efficient apparatus for the production of powerful electrical oscillations, as was needed for that specific purpose, was the key to the solution of other most important electrical and, in fact, human problems. Not only was communication, to any distance, without wires possible by its means, but, likewise, the transmission of energy in great amounts, the burning of the atmospheric nitrogen, the production of an efficient illuminant, and many other results of inestimable scientific and industrial value. Finally, however, I had the satisfaction of accomplishing the task undertaken by the use of a new principle, the virtue of which is based on the marvelous properties of the electrical condenser. One of these is that it can discharge or explode its stored energy in an inconceivably short time. Owing to this it is unequalled in explosive violence. The explosion of dynamite is only the breath of a consumptive compared with its discharge. It is the means of producing the strongest current, the highest electrical pressure, the greatest commotion in the medium. Another of its properties, equally valuable, is that its discharge may vibrate at any rate desired up to many millions per second.

I had arrived at the limit of rates obtainable in other ways when the happy idea presented itself to me to resort to the condenser. I arranged such an instrument so as to be charged and discharged alternately in rapid succession through a coil with a few turns of stout wire, forming the primary of a transformer or induction-coil. Each time the condenser was discharged the current would quiver in the primary wire and induce corresponding oscillations in the secondary. Thus a transformer or induction-coil on new principles was evolved, which I have called "the electrical oscillator," partaking of those unique qualities which characterize the condenser, and enabling results to be attained impossible by other means. Electrical effects of any desired character and of intensities undreamed of before are now easily producible by perfected apparatus of this kind, to which frequent reference has been made, and the essential parts of which are shown in Fig. 6 (p. 188). For certain pur-

poses a strong inductive effect is required; for others the greatest possible suddenness; for others again, an exceptionally high rate of vibration or extreme pressure; while for certain other objects immense electrical movements are necessary. The photographs in Figs. 7, 8, 9, and 10, of experiments performed with such an oscillator, may serve to illustrate some of these features and convey an idea of the magnitude of the effects actually produced. The completeness of the effects of the figures referred to makes a further description of them unnecessary.

However extraordinary the results shown may appear, they are but trifling compared with those which are attainable by apparatus designed on these same principles. I have produced electrical discharges the actual path of which, from end to end, was probably more than one hundred feet long; but it would not be difficult to reach lengths one hundred times as great. I have produced electrical movements occurring at the rate of approximately one hundred thousand horse-power, but rates of one, five, or ten million horse-power are easily practicable. In these experiments effects were developed incomparably greater than any ever produced by human agencies, and yet these results are but an embryo of what is to be.

That communication without wires to any point of the globe is practicable with such apparatus would need no demonstration, but through a discovery which I made I obtained absolute certitude. Popularly explained, it is exactly this: When we raise the voice and hear an echo in reply, we know that the sound of the voice must have reached a distant wall, or boundary, and must have been reflected from the same. Exactly as the sound, so an electrical wave is reflected, and the same evidence which is afforded by an echo is offered by an electrical phenomenon known as a "stationary" wave—that is, a wave with fixed nodes and ventral regions. Instead of sending sound-vibrations toward a distant wall, I have sent electrical vibrations toward the remote boundaries of the earth, and instead of the wall the earth has replied. In place of an echo I have obtained a stationary electrical wave, a wave reflected from afar.

Stationary waves in the earth mean something more than mere telegraphy without wires to any distance. They will enable us to attain many important specific results impossible otherwise. For instance, by their use we may produce at will, from a sending station, an electrical effect in any particular

## THE PROBLEM

region of the globe; we may place it in any position or course of travel, such as a vessel at sea traversed by the same, or it may pass over the earth a way traveling at any rate we desire. With these developments it is possible to anticipate that in a distant most telegraphic message will be transmitted without the need of wires.

For short distances we need the telephone, which requires no wires. The greater the spaces between the more rational becomes the use of wires. The cable is no longer damaged and costly instrument as in the speed of transmission of certain electrical property in its construction. A properly constructed cable, while it will be a great improvement, is not a parable less expense. Not a day passes, I believe, before communication by this new method will become obsolete, for not only will it be cheaper, but also much safer than the old means for isolating which I have contrived, and a privacy can be secured.

I have observed the above only up to a limited distance of a few hundred miles, but inasmuch as the vibrations producible with such apparatus are of such a nature that I feel quite confident of their being such a plant for effecting communication. Nor is this. The measurements and calculations have shown it is perfectly practicable to project electrical movement of such a nature that, without the slightest doubt, it will be perceptible on some of the planets, as Venus and Mars. The possibility of interplanetary communication has entered the stage of reality. In fact, that we can produce a distinct effect on one of the planets in this novel manner, namely, by the use of the electrical condition of the earth, is beyond any doubt. This way of effecting communication is, however, essentially different from all others which have been proposed by scientific men. In previous instances only a minute amount of energy reaching the total energy of the planet, much as it would be possible



region of the globe; we may determine the relative position or course of a moving object, such as a vessel at sea, the distance traversed by the same, or its speed; or we may send over the earth a wave of electricity traveling at any rate we desire, from the pace of a turtle up to lightning speed.

With these developments we have every reason to anticipate that in a time not very distant most telegraphic messages across the oceans will be transmitted without cables. For short distances we need a "wireless" telephone, which requires no expert operators. The greater the spaces to be bridged, the more rational becomes communication without wires. The cable is not only an easily damaged and costly instrument, but it limits us in the speed of transmission by reason of a certain electrical property inseparable from its construction. A properly designed plant for effecting communication without wires ought to have many times the working capacity of a cable, while it will involve incomparably less expense. Not a long time will pass, I believe, before communication by cable will become obsolete, for not only will signaling by this new method be quicker and cheaper, but also much safer. By using some new means for isolating the messages which I have contrived, an almost perfect privacy can be secured.

I have observed the above effects so far only up to a limited distance of about six hundred miles, but inasmuch as there is virtually no limit to the power of the vibrations producible with such an oscillator, I feel quite confident of the success of such a plant for effecting transoceanic communication. Nor is this all. My measurements and calculations have shown that it is perfectly practicable to produce on our globe, by the use of these principles, an electrical movement of such magnitude that, without the slightest doubt, its effect will be perceptible on some of our nearer planets, as Venus and Mars. Thus from mere possibility interplanetary communication has entered the stage of probability. In fact, that we can produce a distinct effect on one of these planets in this novel manner, namely, by disturbing the electrical condition of the earth, is beyond any doubt. This way of effecting such communication is, however, essentially different from all others which have so far been proposed by scientific men. In all the previous instances only a minute fraction of the total energy reaching the planet—as much as it would be possible to concentrate

in a reflector—could be utilized by the supposed observer in his instrument. But by the means I have developed he would be enabled to concentrate the larger portion of the entire energy transmitted to the planet in his instrument, and the chances of affecting the latter are thereby increased many millionfold.

Besides machinery for producing vibrations of the required power, we must have delicate means capable of revealing the effects of feeble influences exerted upon the earth. For such purposes, too, I have perfected new methods. By their use we shall likewise be able, among other things, to detect at considerable distance the presence of an iceberg or other object at sea. By their use, also, I have discovered some terrestrial phenomena still unexplained. That we can send a message to a planet is certain, that we can get an answer is probable: man is not the only being in the Infinite gifted with a mind.

#### TRANSMISSION OF ELECTRICAL ENERGY TO ANY DISTANCE WITHOUT WIRES—NOW PRACTICABLE—THE BEST MEANS OF INCREASING THE FORCE ACCELERATING THE HUMAN MASS.

THE most valuable observation made in the course of these investigations was the extraordinary behavior of the atmosphere toward electric impulses of excessive electromotive force. The experiments showed that the air at the ordinary pressure became distinctly conducting, and this opened up the wonderful prospect of transmitting large amounts of electrical energy for industrial purposes to great distances without wires, a possibility which, up to that time, was thought of only as a scientific dream. Further investigation revealed the important fact that the conductivity imparted to the air by these electrical impulses of many millions of volts increased very rapidly with the degree of rarefaction, so that air strata at very moderate altitudes, which are easily accessible, offer, to all experimental evidence, a perfect conducting path, better than a copper wire, for currents of this character.

Thus the discovery of these new properties of the atmosphere not only opened up the possibility of transmitting, without wires, energy in large amounts, but, what was still more significant, it afforded the certitude that energy could be transmitted in this manner economically. In this new system it matters little—in fact, almost



nothing—whether the transmission is effected at a distance of a few miles or of a few thousand miles.

While I have not, as yet, actually effected a transmission of a considerable amount of energy, such as would be of industrial importance, to a great distance by this new method, I have operated several model plants under exactly the same conditions which will exist in a large plant of this kind, and the practicability of the system is thoroughly demonstrated. The experiments have shown conclusively that, with two terminals maintained at an elevation of not more than thirty thousand to thirty-five thousand feet above sea-level, and with an electrical pressure of fifteen to twenty million volts, the energy of thousands of horse-power can be transmitted over distances which may be hundreds and, if necessary, thousands of miles. I am hopeful, however, that I may be able to reduce very considerably the elevation of the terminals now required, and with this object I am following up an idea which promises such a realization. There is, of course, a popular prejudice against using an electrical pressure of millions of volts, which may cause sparks to fly at distances of hundreds of feet, but, paradoxical as it may seem, the system, as I have described it in a technical publication, offers greater personal safety than most of the ordinary distribution circuits now used in the cities. This is, in a measure, borne out by the fact that, although I have carried on such experiments for a number of years, no injury has been sustained either by me or any of my assistants.

But to enable a practical introduction of the system, a number of essential requirements are still to be fulfilled. It is not enough to develop appliances by means of which such a transmission can be effected. The machinery must be such as to allow the transformation and transmission of electrical energy under highly economical and practical conditions. Furthermore, an inducement must be offered to those who are engaged in the industrial exploitation of natural sources of power, as waterfalls, by guaranteeing greater returns on the capital invested than they can secure by local development of the property.

From that moment when it was observed that, contrary to the established opinion, low and easily accessible strata of the atmosphere are capable of conducting electricity, the transmission of electrical energy without wires has become a rational task of the engineer, and one surpassing all others in importance. Its practical consummation would

mean that energy would be available for the uses of man at any point of the globe, not in small amounts such as might be derived from the ambient medium by means of machinery, but in quantities virtually unlimited, from waterfalls. Export of power would then become the chief source of income for many happily situated countries in the United States, Canada, Central and South America, Switzerland, and Sweden. Men could settle down everywhere, fertilize and irrigate the soil with little effort, and convert barren deserts into gardens, and thus the entire globe could be transformed and made a fitter abode for mankind. It is highly probable that if there are intelligent beings on Mars they have long ago realized this very idea, which would explain the changes on its surface noted by astronomers. The atmosphere on that planet, being of considerably smaller density than that of earth, would make the task much more easy.

It is probable that we shall soon have a self-acting heat-engine capable of deriving moderate amounts of energy from the ambient medium. There is also a possibility—though a small one—that we may obtain electrical energy direct from the sun. This might be the case if the Maxwellian theory is true, according to which electrical vibrations of all rates should emanate from the sun. I am still investigating this subject. Sir William Crookes has shown in his beautiful invention known as the "radiometer" that rays may produce by impact a mechanical effect, and this may lead to some important revelation as to the utilization of the sun's rays in novel ways. Other sources of energy may be opened up, and new methods of deriving energy from the sun discovered, but none of these or similar achievements would equal in importance the transmission of power to any distance through the medium. I can conceive of no technical advance which would tend to unite the various elements of humanity more effectively than this one, or of one which would more add to and more economize human energy. It would be the best means of increasing the force accelerating the human mass. The mere moral influence of such a radical departure would be incalculable. On the other hand, if at any point of the globe energy can be obtained in limited quantities from the ambient medium by means of a self-acting heat-engine or otherwise, the conditions will remain the same as before. Human performance will be increased, but men will remain strangers as they were.

I anticipate these results. I consider them a mass which is as useful an element in human receptivity and in movement. He does not. Daily work—To complete it. Let, oh, let me. No! there is no

LATITUDE.

ONE of M  
delightful  
speaking  
ers of soci

"I don't know that much above us as to times it is longitudinal latitude that separates true, and the philosophy quite as much reform the politics of that matter, of the those who would reform."

There is always a misunderstanding when one writes as this, because the unhealthy extremists of any statement and the opponents. No single sufficient to explain a more than in a sentence possible to treat the party loyalty, and the justice shown, for instance in his recent queerly named Map of Life."

All men in whose character an element of hardened barbarism which we somewhat vaguely when we speak of "reform" sound mind must also admit efficiency. There are, of course, low moral type, or of such



I anticipate that many, unprepared for these results, which, through long familiarity, appear to me simple and obvious, will consider them still far from practical application. Such reserve, and even opposition, of some is as useful a quality and as necessary an element in human progress as the quick receptivity and enthusiasm of others. Thus, a mass which resists the force at first, once set in movement, adds to the energy. The scientific man does not aim at an immediate result. He does not expect that his advanced

ideas will be readily taken up. His work is like that of the planter—for the future. His duty is to lay the foundation for those who are to come, and point the way. He lives and labors and hopes with the poet who says:

Schaff', das Tagwerk meiner Hände,  
Hohes Glück, dass ich's vollende!  
Lass, o lass mich nicht ermatten!  
Nein, es sind nicht leere Träume:  
Jetzt nur Stangen, diese Bäume  
Geben einst noch Frucht und Schatten.<sup>1</sup>

<sup>1</sup> Daily work—my hands' employment,  
To complete is pure enjoyment!  
Let, oh, let me never falter!  
No! there is no empty dreaming:

Lo! these trees, but bare poles seeming,  
Yet will yield both fruit and shelter!  
Goethe's "Hope,"  
Translated by William Gibson, Com. U. S. N.

## LATITUDE AND LONGITUDE AMONG REFORMERS.

BY THEODORE ROOSEVELT.



NE of Miss Mary E. Wilkins's delightful heroines remarks, in speaking of certain would-be leaders of social reform in her village: "I don't know that I think they are so much above us as too far to one side. Sometimes it is longitude and sometimes it is latitude that separates people." This is true, and the philosophy it teaches applies quite as much to those who would reform the politics of a large city, or, for that matter, of the whole country, as to those who would reform the society of a hamlet.

There is always danger of being misunderstood when one writes about such a subject as this, because there are on each side unhealthy extremists who like to take half of any statement and twist it into an argument in favor of themselves or against their opponents. No single sentence or two is sufficient to explain a man's full meaning; any more than in a sentence or two it would be possible to treat the question of the necessity for, and the limitations of, proper party loyalty, with the thoroughness and justice shown, for instance, by Mr. Lecky in his recent queerly named volume, "The Map of Life."

All men in whose character there is not an element of hardened baseness must admit the need in our public life of those qualities which we somewhat vaguely group together when we speak of "reform," and all men of sound mind must also admit the need of efficiency. There are, of course, men of such low moral type, or of such ingrained cyni-

cism, that they do not believe in the possibility of making anything better, or do not care to see things better. There are also men who are slightly disordered mentally, or who are cursed with a moral twist which makes them champion reforms less from a desire to do good to others than as a kind of tribute to their own righteousness, for the sake of emphasizing their own superiority. From neither of these classes can we get any real help in the unending struggle for righteousness. There remains the great body of the people, including the entire body of those through whom the salvation of the people must ultimately be worked out. All these men combine or seek to combine in varying degrees the quality of striving after the ideal, that is, the quality which makes men reformers, and the quality of so striving through practical methods—the quality which makes men efficient. Both qualities are absolutely essential. The absence of either makes the presence of the other worthless or worse.

If there is one tendency of the day which more than any other is unhealthy and undesirable, it is the tendency to deify mere "smartness," unaccompanied by a sense of moral accountability. We shall never make our republic what it should be until as a people we thoroughly understand and put in practice the doctrine that success is abhorrent if attained by the sacrifice of the fundamental principles of morality. The successful man, whether in business or in politics, who has risen by conscienceless swindling of his neighbors, by deceit and chicanery, by



## *Original outline*

### Titles for Chapters.

1. The Onward Movement of Man. - The Forces and Laws Governing the Movement. - The Energy of the Movement. The Three Ways of Increasing Human Energy.
2. The first Problem: How to Increase the Living Mass. The Burning of Atmospheric Nitrogen. - The Second Problem: How to Reduce the Force Retarding the Living Mass. The Art of Telautomatics. - The Third Problem: How to Increase the Force Accelerating the Living Mass. The Harnessing of the Sun's Energy.
3. Man's first Act of Scientific Philanthropy. The Three Great Possibilities in the Utilization of the Sun's Energy: Burning Coal in a Battery; obtaining Energy from the Natural Medium; transmitting Energy through the Natural Medium.
4. Advances in Electrical Energy Transmission. The Rotating Magnetic Field. Transmission through a Single Wire without Return. Transmission through the Earth Alone. System of "Wireless" Telegraphy.
5. The Wonderful Features of the Electrical Condenser. Perfection of the Electrical Oscillator. Production of Oscillations of Great Power. Practicability of Trans-Oceanic "Wireless" Telegraphy Demonstrated. New Principle Offering Possibility of Interplanetary Communication.
6. Production of Extreme Electrical Pressures. Discovery of Conducting Properties of the Atmosphere. Difficulties Overcome and Results Attained. Electrical Power Transmission to any Distance without Wires the Best Way of Harnessing the Sun's Energy.



PROSPECTING FOR MR. TESLA'S NITRATES COMPANY.

~~Mr. Nikola Tesla, whose~~ <sup>discovery</sup> ~~inventions~~ <sup>have</sup> formed the basis of so many ~~more recent practical applications of electricity, and which by~~ <sup>their world-wide recognition have given this inventor a prominent</sup> position in the field of electricity, ~~has, by a series of discover-~~ <sup>ies extending over many years, and all protected by valid patents</sup>

<sup>has evolved a new and efficient process for</sup> ~~in all the great industries of the world, and in the system for~~ the fixation of atmospheric nitrogen, <sup>that is, its chemical combination with</sup> ~~is, in other words, for the~~ <sup>the oxygen of the</sup> ~~atmosphere into~~

~~a substance of great value and wide-reaching influence, which, by its~~ tremendous value and wide-reaching influence, bids fair to outrank many times his wonderful invention of the alternating current motor.

~~It is in this field, especially his own, that his invention~~ (over) x

First, that his high-frequency electric discharges in the atmosphere give in a much more effective degree a peculiar electric chemical stress, which brings about this most difficult of combinations; a stress which all workers in this field have recognised for years as being one which not only must be of tremendous power, but of almost infinite suddenness. The time element which has so materially interfered with the success of other workers in this field, has, by Mr. Tesla's invention, been almost entirely removed as an objection.

Second, Mr. Tesla's peculiar means of obtaining phenomenally high voltages (ranging into the millions of volts) from apparatus of most moderate dimensions enables him to obtain the



early ~~discovery~~ <sup>recognition</sup> of the immense possibilities of such  
 a deposit, and since an article published a few years  
 ago he made the startling prediction that the ~~as a result~~  
 the electrification of atmospheric hydrogen would before long develop into  
 an industry rival to that of iron in importance. At this time nothing had been  
 done towards commercial exploitation. And here is his foresight  
 justified by the fact that in various countries extensive  
 plants have been installed since ~~and large investments have been made~~ <sup>and large investments have been made</sup>. In  
 Norway ~~alone~~ <sup>alone</sup> the ~~10000~~ <sup>10000</sup> ~~horses of electric power~~ <sup>horses of electric power</sup>  
~~is contemplated~~ <sup>is contemplated</sup> and fifty ~~hundred~~ <sup>hundred</sup> ~~are~~ <sup>are</sup> ~~being~~ <sup>being</sup> ~~constructed~~ <sup>constructed</sup>  
~~on the~~ <sup>on the</sup> ~~add~~ <sup>add</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~method~~ <sup>method</sup> ~~and~~ <sup>and</sup> ~~apparatus~~ <sup>apparatus</sup> ~~utilizing~~ <sup>utilizing</sup> ~~no~~ <sup>no</sup> ~~more~~ <sup>more</sup> ~~than~~ <sup>than</sup> ~~a~~ <sup>a</sup> ~~few~~ <sup>few</sup> ~~percent~~ <sup>percent</sup>  
 of the electric energy of the current, and ~~utilizing~~ <sup>utilizing</sup> ~~for~~ <sup>for</sup> ~~the~~ <sup>the</sup> ~~first~~ <sup>first</sup> ~~cost~~ <sup>cost</sup> ~~so~~ <sup>so</sup> ~~great~~ <sup>great</sup> ~~that~~ <sup>that</sup> ~~the~~ <sup>the</sup> ~~business~~ <sup>business</sup> ~~is~~ <sup>is</sup> ~~not~~ <sup>not</sup> ~~yet~~ <sup>yet</sup> ~~practically~~ <sup>practically</sup> ~~attracting~~ <sup>attracting</sup> ~~the~~ <sup>the</sup> ~~capital~~ <sup>capital</sup>.  
 The fixation or burning of atmospheric hydrogen  
 effected successfully ~~by~~ <sup>by</sup> ~~lightning~~ <sup>lightning</sup> discharges which  
 precipitate from four to twenty pounds of nitrogen  
 compounds per acre per year, an enormous amount  
 when considering their scarcity. This high efficiency  
 is due to the great power, suddenness, heat and volume of  
 the discharge, and instant cooling resulting therefrom.  
 These ~~actual~~ <sup>actual</sup> requirements are fulfilled in  
 the new ~~process~~ <sup>process</sup> ~~owned~~ <sup>owned</sup> ~~by~~ <sup>by</sup> ~~the~~ <sup>the</sup> ~~Tosli~~ <sup>Tosli</sup> ~~Nitrogen~~ <sup>Nitrogen</sup> ~~Company~~ <sup>Company</sup>.  
 The "Tosli Transformer" ~~is~~ <sup>is</sup> ~~designed~~ <sup>designed</sup> ~~for~~ <sup>for</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~of~~ <sup>of</sup> ~~virtually~~ <sup>virtually</sup> ~~unlimited~~ <sup>unlimited</sup> ~~power~~ <sup>power</sup> ~~surpassing~~ <sup>surpassing</sup> ~~even~~ <sup>even</sup> ~~those~~ <sup>those</sup> ~~of~~ <sup>of</sup> ~~lightning~~ <sup>lightning</sup> ~~or~~ <sup>or</sup> ~~in~~ <sup>in</sup> ~~called~~ <sup>called</sup> ~~Tosli~~ <sup>Tosli</sup> ~~discharges~~ <sup>discharges</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~peculiar~~ <sup>peculiar</sup> ~~properties~~ <sup>properties</sup> ~~for~~ <sup>for</sup> ~~extracting~~ <sup>extracting</sup> ~~the~~ <sup>the</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~ <sup>of</sup> ~~electric~~ <sup>electric</sup> ~~effects~~ <sup>effects</sup> ~~from~~ <sup>from</sup> ~~the~~ <sup>the</sup> ~~air~~ <sup>air</sup> ~~and~~ <sup>and</sup> ~~the~~ <sup>the</sup> ~~production~~ <sup>production</sup> ~~of~~

× × × × ×



~~attenuated are so necessary for the highest efficiency.~~

~~Third, by virtue of the peculiar nature of Mr. Tesla's transformer, he is enabled to produce a certain tonnage of product with such a small amount of apparatus and a consequently reasonable investment as to multiply a thousand-fold, the capacity efficiency of his plant. This item is of vast importance in connection with this subject. Many experimenters have produced nitric acid from the atmosphere and there are now some very large plants engaged in this industry, especially in Norway, that involves upwards of \$50,000,000, and which will absorb some 200,000 horse power when it is fully expanded, but without exception all these efforts have resulted in a first cost of apparatus so great that the interest and maintenance alone thereof puts a fixed charge upon each ton of the product that has heretofore rendered the business indifferently attractive to capital. Ignoring, there-~~

~~for the moment, the increased efficiency claimed by Mr.~~

~~Tesla, or his novel method of burning the atmosphere, and granting~~

~~only that he shall burn it as it has been done before by attenuated~~

~~that his devices are applied to the old process, the commercial~~

~~apparatus from \$100 per ton of output to \$2 or less, it simply~~

~~of the process absolutely certain if power can be had at a reasonable price, for~~

~~remains to get power at a sufficiently reasonable price to make~~

~~the process of the project absolutely certain. Pure nitric acid~~

~~the plant, instead of costing \$80-100 dollars per ton of annual product, will cost for an~~

~~and its salts (and all nitrates prepared thus from the atmosphere~~

~~are pure, cost from \$100 to \$200 per ton, and even the crude~~

~~100-200 dollars per ton. The acids and its salts thus prepared are of great purity and sell at~~

~~impurities, sell for \$55 and better. A small charge of investment of \$3 or \$10 per ton of put-~~

~~put becomes. The operation of these plants, like those of hydro-~~

~~electric installation, require but little labor~~

~~There is no essential~~



1. This ~~insurmountable~~ <sup>unfoldingness</sup> removes one  
 great obstacle which has so materially ~~weakened~~  
~~frustrated~~ with the success of the old method and <sup>hence</sup> ~~efficiency~~.  
 2. Tesla means for generating enormous electric  
 pressures with ~~operation of~~ <sup>the</sup> ~~discharge~~ <sup>insulation</sup>  
 discharges, ~~available~~ <sup>the</sup> ~~parallelism~~ <sup>of</sup> ~~discharge~~  
 charges of arcs of the great length and volume  
 so necessary to the highest efficiency.

3. This means ~~it is~~ <sup>it is</sup> possible to operate ~~machines~~  
 of any capacity, however great, to burn the air  
 at any desired rate and thus increase  
 a thousand fold the effectiveness of the plant.  
 The Tesla apparatus may be likened to a turbine  
 running at a stupendous speed, while that ~~now~~  
~~employed~~ <sup>now</sup> ~~is~~ <sup>employed</sup> is comparable to  
 an old-fashioned engine turning slowly. For  
 the same performance the latter is overpowered  
 and cumbersome and expensive. ~~The~~  
~~entire~~ ~~by~~ ~~using~~ ~~the~~ ~~first~~ ~~cost~~

4. This is of vital importance to  
 the enterprise reducing as it does, to a ~~mini-~~  
 mum the first cost <sup>the burden of</sup> ~~and~~ <sup>fixed</sup> charges. To  
 illustrate, ~~some~~ <sup>that</sup> disregarding ~~xx~~ (other side)



part <sup>of the plant</sup> ~~of the apparatus~~ that is subject to rapid <sup>deterioration</sup> ~~worn and torn~~; in fact, most of it is <sup>good for one hundred years</sup> ~~good for one hundred years~~, and it consists principally of brick <sup>and metal</sup> ~~buildings~~, <sup>and is good for centuries</sup> ~~transferred, brick or tile construction chambers and equipping powers or their equivalent~~. The process is a continuous one and once started requires no manual labor, <sup>it is electrically</sup> ~~it is electrically~~ continuing to burn the atmosphere into nitric fumes, which in turn combine with water to make nitric acid, and this goes on until the ~~current~~ <sup>head</sup> current is switched off, and immediately recommences when the ~~current~~ <sup>head</sup> current is ~~again~~ switched on. There is no loss upon the discontinuing of the process for an hour, a day, a month or a year, <sup>other than</sup> ~~except~~ that ~~is~~ <sup>the</sup> due to plant lying idle and carrying <sup>no small</sup> ~~its burden~~ of interest. It is obvious, therefore, that it <sup>only remains to obtain power at a sufficiently</sup> ~~only remains to obtain power at a sufficiently~~ reasonable <sup>by the use of this revolutionary process a cost</sup> ~~price to make an almost unobtainable~~ industry <sup>can be built up</sup> ~~of this~~ with a very reasonable investment of capital yielding annually a return many times the first cost.

The Tesla Nitrates Company owns the exclusive rights under ~~the~~ <sup>its</sup> United States patents granted to ~~Mr.~~ <sup>and</sup> Tesla, applicable to the manufacture of nitrates from the atmosphere, <sup>which are the following:</sup>

<sup>It is his own</sup> ~~future~~ <sup>improvements</sup> ~~improvements when they shall be made, relative~~ <sup>to this subject, and will get the benefit of his assistance and advice.</sup>

<sup>It is proposed</sup> ~~to immediately make a demonstration of the~~ <sup>salient advantages of the novel process with a model plant</sup> ~~on the commercial magnitude in the immediate vicinity of New York~~

City, where experts and investors may see <sup>for themselves</sup> ~~the~~ practical application of <sup>his</sup> ~~these~~ inventions, <sup>and judge for themselves of their value.</sup> ~~in a full sized unit~~

<sup>apparatus.</sup> ~~In making this test, Mr. Tesla will have at his~~ <sup>disposal, a plant that has already cost over \$200,000, a large</sup> ~~part of which will be immediately available.~~ <sup>It is estimated that</sup> ~~this test will involve an expenditure of \$25,000~~ <sup>will be ample to meet</sup>



ishing of the additional apparatus, partly for attendance and  
all expenses in this connection. Undoubtedly the plant will serve  
operation and partly for the very full and exhaustive demonstra-  
tion which it is proposed to be made.  
prior to their application on the large scale contemplated.

XXXX # Tesla is now devoting himself to  
the perfection of plans for ~~small~~ <sup>installation</sup> a large plant  
being controlled in this way by a ~~small~~ <sup>very</sup> ~~small~~ <sup>large</sup> ~~number~~ <sup>number</sup>  
of international ~~engineers~~ <sup>engineers</sup> who ~~has~~ <sup>has</sup> ~~been~~ <sup>been</sup> ~~for~~ <sup>for</sup> ~~a~~ <sup>a</sup> ~~long~~ <sup>long</sup> ~~time~~ <sup>time</sup>  
~~has~~ <sup>has</sup> ~~been~~ <sup>been</sup> ~~for~~ <sup>for</sup> ~~a~~ <sup>a</sup> ~~long~~ <sup>long</sup> ~~time~~ <sup>time</sup>  
a long experience in the fixation of nitrogen  
by the old method and is thoroughly familiar  
with all ~~the~~ <sup>the</sup> facts pertaining to the manufacture  
and sale of the products. In the near  
future X X



NIKOLA TESLA.  
PRESIDENT.

COLUMBIA

Spec

# TESLA NITRATES COMPANY

165 BROADWAY

Tesla,  
New  
To C  
a.l.

NEW YORK

Oct. 13 1901

40032E

My dear L. Scherff

The T. Electro Therapeutic Co and the T. Population Co will be incorporated next week.

My new corporation is located in Bridgeport and is just a great thing. This really means a immense revolution in mechanics and there is scarcely a department which was not been previously offered. We expect to create new tools this week and we are keeping our hands and work day & night.

Truly

N. Tesla



NIKOLA TESLA.  
PRESIDENT.

# TESLA NITRATES COMPANY

165 BROADWAY

NEW YORK



Tesla's Correspondence with Relatives PAGE 298

March 4, 1942

N. Tesla to Sava Kosanovic

Western Union

New York, NY

March 2, 1941

Poor with words I still didn't explain it enough it would be necessary to increase up to twelve stations eight for Croatia each of the same construction like at Wardenclyffe and only 20 meters a ball five meters in diameter the station would be using diesel oil for energy with mechanical action my air turbines, steam powered, electrically or other manner and transformed into electrical alternating current un pressure sixty billion volts without danger. I am waiting for Governor Subasic select one station on top of Mt. Lovcen<sup>1</sup>. There will not be any light, electrical energy will deliver particles through space with the speed of 118837370000 centimeters per second. This is 394579 the speed of light. As I said about airplanes it can be used for tanks, trucks, automobiles, various machines in factories, wheels with hydro electrical and unlimited other machines. The particles can be larger than that of the diameter of an Hydrogen atom and with them metals in all kinds of materials send to all distances and good results in war and bring about peace. Particles are practical with neutrons, because 3723 times lighter than electricity or electrons

PAGE 299

that cannot penetrate space for great distances. In my attempts with 20 effective million volts electrons carried 40 times more electricity than normally and penetrated two meters in depth and terrible damage in a moment each pipe I have to finish because that I give you a fresh view. Warmly Greetings. I remain your Uncle, Nikola

PAGE 300

N. Trbojevic to N. Tesla

Tesla's Nephew

letterhead

Toledo, Ohio

June 16, 1941

Nikola Trbojevic  
Mechanical Engineer  
4100 Bennett Road  
Toledo, Ohio, Spicer Eng. Co.

Dear Uncle:

Your telegram of last Saturday I received this morning. (Monday) We do not work Sunday's. I go here with my real name and not Terbo I am surprised about your article that you are planning for Srbobran. You are too late for this, because our poor Yugoslavia is no more. Our Lika and Dalmatia are now under Italy. It is now the best to keep quiet and bear it.

I have been very fortunate with my invention because I received "interference" at the Patent Office, and don't know what it is and will not know for a months. The wife's operation was not too successful and now she has complications.

I am sending you a check for \$50,000 that is all I can put together. What are your difficulties? Did you lose your income?

I still have two more inventions besides this Universal Joint, Will see you., Your Niko

1) Mt. Lovcen is the highest peak in Montenegro.



Tesla's Correspondence with Relatives PAGE 283  
N. Trbojevic to N. Tesla  
Tesla's Nephew

Letterhead

Nikola Trbojevic  
7338 Woodward Avenue  
Detroit, MI

July 14, 1939

Dear Uncle:

I heard that you are ill. How are you? Would you like to move to Detroit? Let me know how you are.  
My work was slow up to now, but I just completed a good "universal joint" and "front wheel drive". I think that I will sell this patent by this summer.

PAGE 284

N. Trbojevic to Hotel New Yorker Manager  
Tesla's Nephew

Aug. 25, 1939  
Detroit, MI

IN ENGLISH

PAGE 285 TRANS. OF 284

Office of Hotel New Yorker  
Mr. N. Tesla  
Room 3327, Hotel New Yorker

PAGE 286

Aug. 26, 1939

Dear Mr. Tesla:

We received the enclosed letter from Mr. Nikola Trbojevic, who states he is your newpew.  
We are sending this letter to you so you may take whatever action you deem necessary or desirable.

With Kind Regards, we remain  
Cordially Yours, Leo A. Melony

PAGE 287 TRANS OF PAGE 286  
PAGE 288

N. Trbojevic to N. Tesla  
Tesla's nephew

Detroit, MI  
Sept. 1, 1939

Dear Uncle:

I received your telegram and all of the data, I was so pleased, that you are alive and well. I don't know who is spreading the news of your so called illness; sister Milica says that it was reported in the newspaper 'vREME'

I am now in trouble and of concern. I have many patents and cannot sell not one. I just did my last one "constant velocity universal joint" which is run by taper rollers. It can increase the torque 2 1/2 more than present ones with wheels. This would be excellent for "front wheel drivees", etc

I think that I can sell this, but nothing is sure in this America

What do you think of Hitler in war? It is catastrophic for all sides.

Love, Niko



Tesla's Correspondence with Relatives PAGE 283

N. Trbojevic to N. Tesla

Letterhead

July 14, 1939

Tesla's Nephew

Nikola Trbojevic  
7338 Woodward Avenue  
Detroit, MI

Dear Uncle:

I heard that you are ill. How are you? Would you like to move to Detroit? Let me know how you are.

My work was slow up to now, but I just completed a good "universal joint" and "front wheel drive". I think that I will sell this patent by this summer.

PAGE 284

N. Trbojevic to Hotel New Yorker Manager  
Tesla's Nephew

Aug. 25, 1939  
Detroit, MI

IN ENGLISH

PAGE 285 TRANS. OF 284

Office of Hotel New Yorker

Mr. N. Tesla

Room 3327, Hotel New Yorker

PAGE 286

Aug. 26, 1939

Dear Mr. Tesla:

We received the enclosed letter from Mr. Nikola Trbojevic, who states he is your nephew.

We are sending this letter to you so you may take whatever action you deem necessary or desirable.

With Kind Regards, we remain

Cordially Yours, Leo A. Molony

PAGE 287 TRANS OF PAGE 286

PAGE 288

N. Trbojevic to N. Tesla  
Tesla's nephew

Detroit, MI  
Sept. 1, 1939

Dear Uncle:

I received your telegram and all of the data, I was so pleased, that you are alive and well. I don't know who is spreading the news of your so called illness; sister Milica says that it was reported in the newspaper 'vREME'

I am now in trouble and of concern. I have many patents and cannot sell not one. I just did my last one "constant velocity universal joint" which is run by taper rollers. It can increase the torque 2 1/2 more than present ones with wheels. This would be excellent for "front wheel drivees", etc

I think that I can sell this, but nothing is sure in this America

What do you think of Hitler in war? It is catastrophic for all sides.

Love, Niko



Tesla's Correspondence with Relatives PAGE 291  
Mara Mucovic to N. Tesla  
Tesla's great niece

Sarajevo, Bosna  
July 29, 1939

My Dear Granfather:

Think about why I am now writing, and I would have written according to me a long time ago. I felt that I would be an intruder if I wrote to you as an orphan of a priest.

Today since I have married with a husband in good standing, I can write to you. I am the daughter of the late Gina and the late very Rev. Petar Lalic. You recognize her as an only child of your late sister and my Grandmother, Milka. The late grandmother Milka lived with my mother and father and where my father was a priest in Pazarica and now all of the three may God save their souls deceased.

I have one brother Nikola, and he received this name from my Grandmother-your sister the late Milka as a reminder of you the only brother! My brother received a Ph.D in Philosophy and suffered without parents and finally became employed as a Journalist in the Zagreb Press Bureau. For his intelligence this is not the best of jobs.

I married an Appellate Court Judge Simo Mucovic who was born in Reinje, Hercegovian and am happily married, because my husband is good and the same luck as my brother. He for his ability and years of service should be president of the Judicial court and not what he is today. You know that what people say: Give birth to me lucky mother and throw me into the water so that I can swim out of it.

As I look behind me I say: Your Dear God gave us what we already have.

PAGE 292

My dear grandfather you are my oldest relative and the closest and I would be happy if I can touch base with you and know how you are.

Thinking of you and I kiss your hand, Your Greatniece, Mara

PAGE 293

N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
Aug. 20, 1940

Dear Uncle:

Here, now my luck has turned for the better since I received a good contract from Spicer Mfg. Co. in Toledo, Ohio. I shall work (and an agreement) two of my inventions which I think are good and will have a significant input in the construction of automobile trucks, gyrosopes, etc. The first is the constant velocity universal joint, which contains of 4 pieces from which two are screws. The other is a new type of hypoid gear that will be cut at Fellows Gear Shaper. When there is progress if my stomach or some other catastrophe hits, I will tell you about it.

I had a lot of suffering until I had these two problems solved. About the universal joint I worked six years and tried all possible (like Edison) things until I saw clearly the truth.

How are you? How is your health? I am very concerned about the war and ours at home who are in serious danger.

Please write from time to time. I will have this office for a time until I see how things go. They (Spicer) pay me very well and have a possibility of good royalties.

Hug you you Nephew, Niko.



Tesla's Correspondence with Relatives PAGE 298  
 March 4, 1942  
 N. Tesla to Sava Kosanovic  
 Western Union

New York, NY  
 March 2, 1941

Poor with words I still didn't explain it enough it would be necessary to increase up to twelve stations eight for Croatia each of the same construction like at Wardendlyffe and only 20 meters a ball five meters in diameter the station would be using diesel oil for energy with mechanical action my air turbines, steam powered, electrically or other manner and transformed into electrical alternating current un pressure sixty billion volts without danger. I am waiting for Governor Subasic select one station on top of Mt. Lovcen<sup>1</sup>. There will not be any light, electrical energy will delivers particles through space with the speed of 118837370000 centimeters per second. This is .394579 the speed of light. As I said about airplanes it can be used for tanks, trucks, automobiles, various machines in factories, wheels with hydro electrical and unlimited other machines. The particles can be larger than that of the diameter of an Hydrogen atom and with them metals i all kinds of materials send to all distances and good results in war and bring about peace. Particles are practical with neutrons, because 3723 times lighter than electricity or electrons

PAGE 299

that cannot penetrate space for great distances. In my attempts with 20 effective million volts electrons carried 40 times more electricity than normally and penetrated two meters in depth and terrible damage in a moment each pipe I have to finish because that I give you a fresh view.  
 Warmly Greetings, I remain your Uncle, Nikola

PAGE 300

N. Trbojevic to N. Tesla  
 Tesla's Nephew

letterhead

Toledo, Ohio

June 16, 1941

Nikola Trbojevic  
 Mechanical Engineer  
 4100 Bennett Road  
 Toledo, Ohio, Spicer Eng. Co.

Dear Uncle:

Your telegram of last Saturday I received this morning. (Monday) We do not work Sunday's. I go here with my real name and not Terbo. I am surprised about your article that you are planning for Srbobran. (You are too late for this, because our poor Yugoslavia is no more. Our Lika and Dalmatia are now under Italy. It is now the best to keep quiet and bear it.

I have been very fortunate with my invention because I received "interference" at the Patent Office, and don't know what it is and will not know for a months. The wife's operation was not too successful and now she has complications.

I am sending you a check for \$50,000 that is all I can put together. What are your difficulties? Did you lose your income?

I still have two more inventions besides this Universal Joint, Will see you., Your Niko  
 1) Mt. Lovcen is the highest peak in Montenegro.





So you will hear from me again. How are you and how are your things moving?

With kindest regards  
yours sincerely  
Nikola

P.S. I am also enclosing a reprint with notations.

**Превод:**

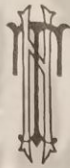
Драги господине Тесла: -

Стигао сам овде прошле недеље у добром стању и затекао Алису и малог Џекија исто тако добро. Мој посао код Timken није тако добро, пошто они нису ништа урадили на мом раду док сам био отсутан, тако да сам изгубио цела два месеца. Ви и сами знате како је то: чим изађете из фабрике они престану да раде на вашем плану уз најмање извињење.

Послаћу вам документа патената и тд. чим будем имао мало више времена и чим их добијем. Шаљем Вам поштом две фотографије на којима је Џеки. Фотограф је направио неких 19 његових фотографија и молио за дозволу да користи слике за рекламу. Фотограф је рекао да је Џеки најлепша беба од 700 беба које су учествовале на некој врсти такмичења. Могуће је да ћете видети ускоро његову слику у "Sat. Evening Post"

Прегледао сам ситуацију резних алата и изгледа да ће бити тешко урадити било шта у том правцу, пошто су садашњи алати за обраду метала чудо перфекције и неколико су стотина пута бољи од оних од пре пет година. Са друге стране, ја имам добре изгледе са својим ваљкастим глодалом за зупчанике које ће осетно смањити трошкове алата





226.

Никола Трбојевић – Николи Тесли  
Детроит, 14. октобра

The Timken Detroit Axle Co.  
General Office  
104-400 Clark Avenue  
Detroit, Michigan

Oct. 14.

Dear Mr. Tesla: –

I arrived here last week in good order and found Alice and the little Jacke also well. My job here at Timken's is not so good as they did not do a thing on my work while I was away, so I lost the two months completely. You know yourself how it is: as soon as you step outside of the plant they stop working on your proposition as the slightest excuse.

I will send you those patent papers etc. as soon as I will have a little more time and as soon as I got them. Now I am mailing you two photos of Jackie's. The photographer took some 19 pictures of him and aksed the permission to use the pictures for advertising. The photographer said Jackie was the best looking baby of 700 that pariticipated in some sort of contest. It is possible that soon you will be able to see his picture in the Sat. Evening Post, etc.

I was looking over the tap situtation and it seems it will be difficult to do anything in that line as the present taps are the marvels of perfection and are several hundred per cent better then they used to be only five years ago. On the other hand, I have a fair chance with my new gear hob that is going to cut down the tool cost quite considerably.

Correspondence -  
Correspondence with Relatives



Tesla's Correspondence with Relatives PAGE 305  
WESTERN UNION TELEGRAM

N. Tesla to Sava Kosanovic  
Tesla's Nephew

To: Belgrade Yugoslavia

New York, NY  
Dec. 26, 1941

I have discovered not long ago a new main transmission of unlimited power for the complete defense of our dear homeland. This force that I practically showed will give Yugoslavia unusual power, because she will be able to destroy all gunpower, etc. I will explain everything through me representative. I have worked out means for this difficult job and please send me by telegraph \$500 at least to Hotel New Yorker. I am very happy that I can help our homeland. Greetings from Your Uncle Nikola Tesla

PAGE 306

Sava Kosanovic to N. Tesla  
Tesla's Nephew

Yugoslav Minister of State

April 2, 1942  
New York, NY

Dear Uncle:

I beg of you kindly to send this telegram

Bad people in Pittsburgh are using your name evilly, and together with the Bishop Verinac announced as the Honorary President of Serbian National Defense, whose objective is to fight against Yugoslavia, against the Croats, against the Government in London, and I don't have to tell you what they say about me.

The Bishop and Verinac (SNF president) refused to accept our telegram. It would be better if you sent it. I respect You and Greet you, Your Nephew Sava N. Kosanovic

PAGE 307

Sava Kosanovic to N. Tesla  
Tesla's Nephew

Minister of State

April 26, 1942  
New York, NY

Most Respectful Uncle:

I was yesterday in Washington, D C could not answer immediately.

I ask you please to sign your fine name so that we can publish it with your signature.

Signed, I ask you to send it down to the Information desk of your hotel addressed to my name. I shall come myself to pick it up. Your Nephew, Sava N. Kosanovic

PAGE 308

Marica Kosanovic to N. Tesla

Plaski, Lika Yugoslavia

Tesla sister

POSTAL TELEGRAPH

Sent to: Hotel Pennsylvania, New York

I send Love and Greetings from your old sister, Marica Kosanovic

WESTERN UNION CABLEGRAM PAGE 309

Sava Kosanovic to N. Tesla from Zagreb

no date

Sent to Hotel New Yorker to N. Tesla

To my Dear Uncle Birthday Greetings

I hope that you realize some of your great ideas that can help mankind

Sava Kosanovic

PAGE 310 IS IN ENGLISH

PAGE 311 IS TRANSLATION OF 310

PAGE 312 IS " " "



Tesla's Correspondence with Relatives PAGE 314  
N. Trbojevic to N. Tesla  
Tesla's Nephew

Detroit, MI  
April 19 no year

Dear Uncle:

I cannot understand why all of my letters at least even one was not answered?  
My job is going badly, I have so many patents, but all are very thin.  
I met with A.H. Starret from Athol, Mass. They ask about you and wonder if you compelled that  
tachometer or abandoned it. They say if you have any data, that they would accept it.  
I don't hear much from the old country, there must be a severe depression there.  
Write at least a few words I am so afraid I why you are so quiet.

Greetings, Your Niko

PAGE 315 LAST LETTER

N. Trbojevic to N. Tesla

Hyde Park, no date

My Dear Uncle:

I just now received your dear letter in which I am replying immediately. I am sorry that you are  
in such dire straits; I understand fully what that is from my own experiences.

My wife and child are well and things are about the same, for now. At GM I failed with my  
steering gear because it fell apart after 8,000 miles and while I expected 100,000 miles. We  
shall try again with harder steel and more exact measurements. I am afraid they will reject it  
before they try it.

At Timken I am going this week to work on a dynamometer with 3 axles and will let you know  
how it comes out.

As to oil pumping action, this is the situation- rest of letter is in English

END OF LETTERS



[On Jan. 7, 1943, Kosanović, upon coming into Tesla's room with a friend, found him dead.]

[He was given an imposing funeral. Cremation followed; his ashes were placed in a temporary grave until a permanent place is decided upon. La Guardia read the funeral obituary prepared by Louis Adamic.]



# НИКОЛА ТЕСЛА

ПРЕПИСКА СА РОДБИНОМ

МУЗЕЈ НИКОЛЕ ТЕСЛЕ

Београд 1993.



## Tesla Memorial Society, Inc. Newsletter

Fall Issue 1993

LELAND I. ANDERSON, one of the most knowledgeable Tesla buffs has a list of books and periodicals for sale. Address: Leland I. Anderson, 2525 S Meade Street, Denver, CO 80219.

A NEW BOOK titled "The God Particle" by Lederman and Weinberg mentions 'Rudger Boskovich' as among the great scientists of the world. Boskovich's "Theory of Natural Philosophy" was the philosophical precursor to the "Theory of Relativity."

Tesla called him the 'Father of that theory.'

MEMBERS WHO ARE INTERESTED in the Tesla Coil and some of the construction problems, we recommend "Tesla Coil Builders Association." Mr. Harry Goldman, editor of a quarterly magazine has many articles of input for coil building, etc. Address is: 3 Amy Lane, Queensbury, NY 12808.

### Nikola Tesla Subject of National Public Radio Program

THE TALK OF THE NATION on NPR 4/21/93 was devoted to Tesla on a one hour broadcast. Participants were Bill Wysock, Margaret Cheney, Charles Ruch of Westinghouse and Wm. H. Terbo. Audio cassette can be purchased at NPR, 2025 M St NW, Washington, DC 20036. \$12.50.

A MEMBER OF TMS, INC. by the name of Countess is the founder of Tesla Pathfinders. Her address is: PO Box 464, Palm Beach FL 33480. She recently held a seminar with 35 people present. She is a poet and we will print some of her works in ensuing issues.

### A Letter from a New Member from Puerto Rico

CARLOS J. CANGGIANO, an attorney from San Diaz, Puerto Rico wrote this letter to us.

Dear Mr. Kosanovich:

"I am pleased to join the Tesla Society ... perceive with great joy a renewed interest in the figure of our admired Dr. Tesla. Should it be that the Establishment has a necessity for his recognition, or a belated remorse for his bolivion? I enclose a photocopy of an article titled Nicola Tesla: Creador del Siglo XX featured in "Enigma" magazine #53 - published in 1992 in Puerto Rico. This article stressed the reality of conspiracy of oblivion. I include also an intriguing article published in "Enigma" #39 - about an obscure Russian scientist: Mikhail Mihajlovich Filipov, who seems to be a contemporary of Dr. Tesla. My Curriculum Vitae is enclosed with photo."

Cordially,

Carlos J. Canggian.

*He is now our Correspondent for Puerto Rico!*

### Letter from MIT

Dear Sirs:

"I am planning to prepare an exhibit for the MIT infinite corridor which will highlight Nikola Tesla, a famous Yugoslav-American inventor. I have already made two displays in the MIT Science and Engineering Libraries, but for this next one I need more materials. I would appreciate if you could send me data, etc."

Sincerely,

Dragica Mijalovic, Sr. Proc. Asst., MIT Science Library, Rm 145-136, Cambridge MA 02139.

### Our Society has the following videotapes for sale:

1. Tesla: The Genius Who Lit the World. 30 minutes. \$19.95 plus postage.
2. Belgrade, 6,000 Years of History. 30 minutes. \$19.95 plus postage.
3. Kingdom of Montenegro (Color). 1 hour. Vintage film. \$24.95.
4. Rudger Boskovich. Scientist, philosopher, etc. His theory of Natural Philosophy is precursor of relativity! 90 minutes. \$29.95.

### The following books are available:

1. Tesla: Man Out of Time. M. Cheney. Paperback. \$5.00 plus \$1.00 postage.
2. My Inventions (Autobiography). Editor: B. Johnston. \$7.95.
3. Prodigal Genius. O'Neill. Paperback. \$8.95.
4. Colorado Springs Notes. \$100.00. Leatherbound. Tesla's Colorado exp.
5. Tribute to Nicola Tesla. \$75.00.
6. Catalog of Tesla Patents. Bilingual. \$4.00 plus \$1.00 postage.
7. Photos of Tesla. 4x6. \$1.00-lab. Colorado Springs; Facade of Bldg., etc. Wardenclyffe Tower.
8. Love Letters. Albert Einstein-Mileva Maric. \$19.95. Hardcover.

The Tesla Museum in Belgrade has most of the documents and data in detail about this great man. The address is: Muzej Nikole Tesle, Dr. A. S. Marincic, Dir., Proleterskih Brigada 51, 11000 Belgrade, Serbia, Yugoslavia.

There are more than 100,000 pieces of correspondence with some of the greatest men in science and technology at the time.

If there are other detailed questions, please request them of us.

### IV International Nikola Tesla Symposium

135TH ANNIVERSARY of Nikola Tesla's birth. An anthology of 40 technical papers are available at \$32.50. Sponsored by the Serbian Academy!

We have separate papers from the 1991 International Tesla Symposium held in Belgrade, 1991. They are \$2.00 plus postage. Please advise if you want specifics on these papers.

### New

THE TESLA MUSEUM IN BELGRADE just printed a book of correspondence with Nikola Tesla and his relatives. 397 pp. We have ordered 50 copies. It is in Serbo-Croatian with Cyrillic and Latin alphabets.

The Tesla Memorial Society, Inc. has been given the rights to have an English translation. Please advise if you are interested!!! We need a minimum of 2,000 copies to print them. The book sells for \$19.95 plus postage. Orders can be sent now.

COLOR PHOTOS OF PUPIN LAB AT  
COLUMBIA UNIVERSITY ARE FOR SALE FOR  
\$1 PLUS 50 CENTS POSTAGE

A REMINDER:  
ANNUAL DUES ARE DUE IN JUNE



Letter arrived @ Cal. Apr.

May 18, 1899

(#81)

---

Letter to Family:

(#82)

May 24, 1899, (pp. 115 - 117)

---

Undated reply

(#82)

p. 118

---

October 24, 1899

#83

p. 119

---

Dec. 7, 1899

#84

pp. 120 - 121

---



**TESLA'S CORRESPONDENCE WITH RELATIVES**  
**TRANSLATOR, NICHOLAS KOSANOVICH**

**PREFACE BY DR. A.S. MARINCIC, DIRECTOR TESLA MUSEUM**

There are about 70,000 letters of correspondence and about 7,000 correspondents. This book contains the original letters to his relatives and those letters received by him-including telegrams. These letters were written during a 60 year period from 1882 to 1942. It is logical that there are about seven times more letters written to him than by him to others. A large number of correspondence to Tesla were from other sources and even up to the present a small number of his descendants gave few copies to the **Nikola Tesla Museum**. Tesla himself did not replicate his correspondence to others.

Most likely the reader will see no replies to letters about interesting questions or discussions from the letters that can be anticipated by any collection of this type of correspondence. In fact, we should be most grateful that Dr. Tesla preserved all of these letters which were precious memories to him and they were spiritual ties with his sisters and close relatives with whom he corresponded. Undoubtedly, this correspondence had significant historical value to the personal life of Tesla and for a better understanding of his views about human problems and of his close relatives and friend.

A very huge effort was demanded to prepare this collection of Tesla correspondence from the phase of collating, deciphering handwritten letters to preparing documents that enabled us to identify the people in Tesla's family tree of both his father and mother up to the phase of comments and compilation the register of names, geographic locations and correspondence. The workers at the Nikola Tesla Museum deserve a special appreciation of gratitude for its diligent work. A special thanks to **Dubravka Smiljanic and Zorica Civric who is also the Curator of the Museum**. We would like to remind the reader that this is the first of its kind of anthology in Yugoslavia and the world. **The staff prepared this with professional presence and enthusiasm.**

This anthology of correspondence was published in the year that was proclaimed-"Year of Nikola Tesla in Yugoslavia and marks the 50th anniversary of his death-one of the great engineers of all time-1993. It is also a significant anniversary--100th Anniversary of the Chicago Exposition where Tesla's polyphase system began its triumphant application to the world. Only 100 years ago electrification of Serbia was introduced in Belgrade 1892. The world was the beneficiary from many of Tesla's inventions; many are still utilized today, and most likely in the future.

Tesla's correspondence in this collection is only a portion of his rich legacy which is in the **Nikola Tesla museum** for posterity. This museum will publish more books in the future. To everyone who assisted in this endeavor-in the first place the **Electrical Industry of Serbia** and the tireless inspiration and organization by **Radmila Ivankovic and those engineers**, Also the donors who helped fund the cost of this book. We hope that she will be a participant in the next publishing effort by the Nikola Tesla Museum, We owe much to one of the greatest Serb cosmopolites who was an inspiration to many in the past and those in the future.

**BELGRADE, JUNE 1993**

**PROFESSOR DR. ALEKSANDAR S. MARINCIC**  
**BELGRADE UNIVERSITY**  
**DIRECTOR, TESLA MUSEUM**

*Rec'd from TMS July 1994*



From Milton Rodinich  
12-16-93

Leland, this could  
also be of some  
small interest to  
you! - M.

This letter is very interesting and is just being published in Književnost  
It was sent to his uncle, before his Niagara works and he said in letter  
that if this experiment succeeds my machines could also be used over there too.  
This will bring more money with which I could help my family.

## IV Svet knjige

DRAGAN KOLUNDŽIJA

### Moja kuća u Istri

Kuća u kojoj sam voleo Hrvatsku.  
Šta je sa njom?  
Je li moja?

Znam veliki rad majstora na njoj.

Znam odricanje.

Znam sve što sam ovdje

I u dva maha u Francuskoj

Za nju izdvojio.

Uštedeo.

Ali, o tome neću ništa reći.

I to me ne muči.

(Nad mladim zaustavljenim životima —  
svetlima!)

A pevam da mi ne bi sve uzeli.

IZ TESLINE PREPISKE

### Najgore je što nema vina

„Književnost“, 9-10/1993.

Nikola Tesla — Paji Mandiću  
Njujork, 20. oktobra 1893.

Dragi ujače,

Vaše pismo od 25. sept. dobio sam ima dva ili tri dana  
te nadoh danas vremena da Vam sa nekoliko riječi od-  
govorim.

Bilo mi je milo kad sam doznao da ste ostavili službu  
i da ste se odlučili na miran život sa Vašom obitelji. Tim  
ste njima dobro učinili, a i sebi samom, jer tamo sad iz-  
gleda kao da će biti bure, a Vi bogme niste već mladić  
akoprem se osjećate još reiselustig. Mene bi neizmerno  
radovalo da ste ovamo došli da vidite čikašku izložbu,  
na dobro Vas je i ujak Petar savjetovao, jer bilo je ovdje  
velika masa puteva nesigurna usled toga, kolizija na že-  
leznicama svaki dan, a opet finansijska panika da tako-  
ve još Amerika nije vidjela. Sad sve bolje izgleda i po svojoj  
prilici uboljšanje će biti stalno, nu trebati će najmanje  
dvije do tri godine dok se teške rane koje su industriji  
zadane zaliječe i poverenje sasvim povrat. Imao bi Vam  
mnogo kočšta da javim. Na zahtev mnogije znanaca  
držao sam pred znanstvenim kongresom predavanje u  
kom sam pokazao moje pronalaski na kojima sad ra-  
dim. To su nove parne i električne mašine od kojih  
nekadum veliki uspeh. Isto tako i motori koji su



BORBA

LETYKAT 25. 11. 1993

20. 11.

Because I prefer quality and not quantity. The editors  
made title out of this shit.



COPY WITH NOTATIONS



RELATIVE MERITS OF  
THE LUCAS METHOD OF PROSPECTING BY DETONATIONS OF EXPLOSIVE COMPOUNDS  
AND OF  
THE TESLA METHOD OF PROSPECTING BY ISOCHRONOUS OSCILLATIONS  
THEORETICALLY CONSIDERED

[1939]





## I.

### REACTIVE FORCE OBTAINABLE BY NITROGLYCERINE AND DYNAMITE

In prospecting for valuable underground deposits, as mineral ores and oil, explosives are now employed producing shocks in the earth which can be detected, at some distance, by seismographic instruments and from which some useful inference as to the character of the subterranean strata can be gained. The method is inefficient and uncertain but has, nevertheless, yielded good results in many instances. There are, however, practical difficulties in its application which often prove unsurmountable. Permits must be obtained from the local authorities and owners of the land, various charges defrayed, interests sacrificed and guarantees given against damage to persons and property. Moreover, the handling of explosives requires extreme care and their cost and preparatory work involve considerable outlay.

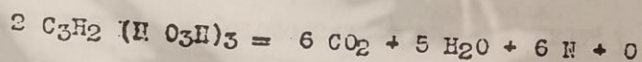
There are very many dynamites now in use, some being compounds of great complexity, and the effects obtainable vary accordingly in energy and power, but the chief object in all of them is to secure the maximum shattering action. The original dynamites of Nobel, consisting of nitroglycerine and a pulverized neutral body, like kieselguhr, excel in this feature and, being stable to a remarkable degree, they are resorted to most generally. In such a mixture all the heat





developed in the explosion is furnished by nitroglycerine, and the theoretical determination of the result is comparatively simple.

According to Berthelot, the chemical process taking place in the combustion of this substance is symbolically expressed by the equation



The heat liberated:

At constant pressure, (water liquid)  $\left\{ \begin{array}{l} 1570 \text{ Cal. per kilogram;} \\ \text{or} \\ 6217 \text{ B.T.U. per pound;} \end{array} \right.$

At constant volume,  $\left\{ \begin{array}{l} 1579 \text{ Cal. per kilogram;} \\ \text{or} \\ 6255 \text{ B.T.U. per pound.} \end{array} \right.$

The volume of the gases at temperature  $t$

$467 \left(1 + \frac{t}{273}\right)$  litres per kilogram, or  $\left. \begin{array}{l} 7.4206 \left(1 + \frac{t}{273}\right) \text{ cubic feet per pound} \end{array} \right\} \text{ water liquid;}$

$713 \left(1 + \frac{t}{273}\right)$  litres per kilogram, or  $\left. \begin{array}{l} 11.42 \left(1 + \frac{t}{273}\right) \text{ cubic feet per pound} \end{array} \right\} \text{ water gaseous.}$

In making the calculations the latter relation should be adopted as the water is always in the state of steam.

The theoretical temperature, determined under the usual assumptions, is

$$\frac{335600}{48} = 6980 \text{ Centigrade, or } 12596 \text{ Fahrenheit.}$$

As a test of the correctness of this value, the calculation may be performed by the aid of my table of specific heats



$$C_p \times t = 0.212868t + 2.33345 \times 10^{-5} t^2 = 6217$$

$$2.33345 \times 10^{-5} t^2 + 0.212868t - 6217 = 0$$

Solving for  $t$ ,

$$t_F = \frac{-0.212868 \pm \sqrt{0.212868^2 - 4 \times 2.33345 \times 10^{-5} (-6217)}}{2 \times 2.33345 \times 10^{-5}} = 4.6669 \times 10^{-5}$$

$$= \frac{-0.212868 + 0.0453127 + 0.580282}{4.6669 \times 10^{-5}} = 0.625595$$

$$= \frac{-0.212868 + 0.790945}{4.6669 \times 10^{-5}} = 0.578077$$

$$= -4561 + 16948$$

$$= 12387^\circ F$$

Calculating the Centigrade equivalent we obtain,

$$t_C = \frac{5}{9} (F - 32)$$

$$= \frac{5(12387 - 32)}{9}$$

$$= \frac{5 \times 12355}{9}$$

$$= 6864^\circ C$$

Note: Despite the fact that the equation is expressed in Fahrenheit,  $T_{\text{test}}$  presents Centigrade <sup>conversion</sup> value first.





based on the theory of linear relation between this constant and the temperature and checked by practical data. I find that the specific heat of the combustion products at constant pressure is

$$c_p = 0.212168 + 0.0000233345 t.$$

Thus, for one pound of nitroglycerine  $c_p \times t = 6217$  B.T.U., i.e.

$$c_p \times t = 0.212868 t + 0.0000233345 t^2 = 6217.$$

The solution of this equation gives

$$t = -4561 + 16948 = 6864 \text{ Centigrade or } 12387 \text{ Fahrenheit.}$$

Considering now a 70% dynamite, that is, one composed of 70% nitroglycerine and 30% inert matter, it is evident that the heat disengaged, the temperature of the gases and their volume, will be about 70% of the values found for the first named substance. Hence the quantities will be as follows:

Heat liberated per kilogram  $0.7 \times 1570 = 1099$  Calories; or

" " " pound  $1099 \times 3.96 = 4352$  B.T.U.;

Temperature of the gases  $0.7 \times 6980 = 4886^\circ \text{C.}$ , or  $8827^\circ \text{F.}$ ;

Volume of gases per kilogram  $0.7 \times 713 (1 + \frac{4886}{273}) = 9432$  litres;

" " " " pound  $\frac{9.432 \times 35.3148}{2.2046} = 151.09$  cubic feet.

Investigations have shown that the work of the expanding products of combustion is only 44% of the potential energy of the explosive, so that, per pound of this compound but  $0.44 \times 4352 = 1915$  B.T.U. are theoretically available for the production of mechanical effects. If there were no other drawbacks the gases would attain a velocity given by the equation





$$1915 \times 778 = \frac{1}{2} \times \frac{1}{32} \times v^2$$

which is satisfied when

$$v = \sqrt{64 \times 1915 \times 778} = 9765 \text{ feet per second.}$$

But in actual experiments through expanding nozzles not more than 8000 feet per second are obtainable, and it is certain that, in such applications as prospecting, the velocity will be much smaller. Assuming the maximum realizable, the force of reaction per pound of this dynamite would be

$$f = \frac{m v}{t_1} = \frac{8000}{32 t_1} \text{ pounds,}$$

$t_1$  being the time consumed in the escape of the gases from the container. Let the latter be a cube with the topside open then, since the specific gravity of the compound is 1.5 and a pound of water takes up  $\frac{1}{62.425}$  of a cubic foot, a pound of dynamite will occupy

$$\frac{1}{62.425 \times 1.5} = \frac{1}{93.6375} = 0.01068 \text{ of a cubic foot.}$$

The side of the cube will be

$$a = \sqrt[3]{0.01068} = 0.22 \text{ of a foot, and}$$

the opening at the top will thus have an area

$$A_0 = 0.22 \times 0.22 = 0.0484 \text{ of a square foot}$$

so that, at the velocity of 8000 feet,  $8000 \times 0.0484 = 387.2$  cubic feet of gas would escape in one second. The actual





volume being 151.09 cubic feet

$$t_1 = \frac{151.09}{387.2} = 0.39 \text{ of a second.}$$

Consequently, the force of reaction

$$f = \frac{8000}{32 \times 0.39} = 641 \text{ pounds per pound of 70\% dynamite.}$$

But this is far above any result obtainable in practice. In the first place, the energy radiated per second at the absolute temperature of  $8827 + 461 = 9288^\circ$  F. and from a surface

$$6 A_0 = 6 \times 0.0484 = 0.2904 \text{ of a square foot is}$$

$$\frac{0.16 \times 0.2904}{3600} \times \left( \frac{9288}{100} \right)^4 = 960.6 \text{ B.T.U.}$$

and during 0.39 of a second would be about 375 B.T.U. Although the radiation diminishes rapidly with the fall of temperature the loss is considerable. Then again, the unavoidable yielding of the enclosure of the charge detracts from the useful effect. The chief economic disadvantage, however, is due to the fact that the explosion develops an immense force in a very short time interval in consequence of which most of the energy of the shock is lost in heat, so that comparatively little of it remains for the production of mechanical effects at distance. Undoubtedly, if the opening for the escape of the gases, instead of being  $A_0 = 0.0484$  of a square foot, as assumed, were greatly reduced so as to prolong the discharge correspondingly, the reactive force, while smaller, would be more effective, at distance.



NOTE: TYPE IN  
TEXT

Correct  
B.T.U./M  
(from p. 2)

$$C_N \times t = 0.160413 t + 1.75844 \times 10^{-5} t^2 = 6253$$

rearranged

$$1.75844 \times 10^{-5} t^2 + 0.160413 t - 6253 = 0$$

Solve for t,

$$t_F = \frac{-0.160413 \pm \sqrt{0.160413^2 + 4 \times 1.75844 \times 10^{-5} (-6253)}}{2 \times 1.75844 \times 10^{-5}} = 3.51688 \times 10^{-5}$$

$$= \frac{-0.160413 + \sqrt{0.027323 + 0.439821}}{3.51688 \times 10^{-5}} = 0.463553$$

$$= \frac{-0.160413 + 0.680847}{3.51688 \times 10^{-5}} = 0.520434$$

$$= -4561.23 + 19401.13$$

$$= 14839.9^\circ F$$

Tala gave 19002.02

The value under the radical was calculated incorrectly by Tala.

Note: Despite the fact that the equation is expressed in Fahrenheit,

Tala presents Centigrade conversion value first (although incorrect).

Calculating the Centigrade equivalent we obtain,

$$t_c = \frac{5}{9} (F - 32)$$

$$= \frac{5(14839.5 - 32)}{9}$$

$$= 8326.389^\circ C$$





Suppose the time were lengthened to one second, the force of reaction would be  $8000/32 = 250$  pounds per pound of dynamite and that is, in all probability, more than can be realized in practice. Some prospecting companies employ charges of 150 pounds and in such cases it is desirable to still further prolong the detonation.

Considering now the results at constant volume, according to my calculations the specific heat is

$$C_v = 0.160413 + 0.0000175844 t \text{ and}$$

$$C_v \times t = 0.150413 t + 0.0000175844 t^2 = 6253$$

The solution of this equation gives

$$t = -4561.23 + 19401.13 = 14440.8 \text{ Centigrade or } 26025.4 \text{ Fahrenheit.}$$

The greatest handicap of the Lucas method is encountered in recording the effects at distance as the ballistic instrument generally adopted is subject to one single impulse and amplification by resonance is impossible. The energy actually available for the operation of the receiver is quite insignificant.

The Lucas method has been used many years without material improvement. Some success is being attained but the experts seem to rely more on their knowledge of Geo-Physics and scientific intuition than on the graph of the recorder and the location of the underground deposit sought is, to a large extent, guesswork.



IIREACTIVE FORCE OBTAINABLE BY TESLA'S ISOCHRONOUS OSCILLATIONS

These are generated by Tele-Geo-Dynamic transmitters which are reciprocating engines of extreme simplicity adapted to impress isochronous vibrations upon the earth, thereby causing the propagation of corresponding rhythmical disturbances through the same which are, essentially, sound waves like those conveyed through the air and ether. The energy carried by such waves per square centimeter per second is

$$E = 2 R_0 \pi^2 V A^2 / L_a^2$$

$R_0$  being the density,  $V$  the velocity,  $A$  the amplitude and  $L_a$  the wave length.

Applying this equation to different media it is found that for the same wave length and amplitude air conveys 50,000 times more energy than the ether and the earth over 20,000,000 times more than the air. Due to its great density the displacements in the earth are so minute that it behaves like a perfectly elastic body conveying the impulses to any distance without loss. This is the reason why Tele-Geo-Dynamic transmitters enable the attainment of many scientific and commercial results of inestimable value. Among others they offer the best means for prospecting, incomparably more economical and effective than any known heretofore, making possible the accurate and unmistakable location of oil, coal, sulphur, iron and other mineral deposits in the





simplest, cheapest and least objectionable manner. With a machine of this kind it will be practicable, in the differentiation of densities and aggregate states of subterranean strata and tracing of their outlines on the earth's surface, to reach a precision approximating that which is secured in the investigation of the internal structure of bodies by penetrative rays. For just as the vacuum tube projects Roentgen shadows on a fluorescent screen, so the transmitter produces on the earth's surface shadows which can be detected by acoustic devices or rendered visible by optical instruments. The receiver can be made so sensitive that prospecting may be accomplished while riding in a car and without limit of distance from the transmitter.

The experts of the Texas Company have asserted emphatically that isochronous impulses, as generated by my machine, are entirely unsuitable for locating ore deposits. But just the opposite is true for the impulses are absolutely non-interfering, each succeeding being a precise repetition of the preceding so that the whole effect on the receiver is proportionate to their number. Far from being uncertain as to direction they are greatly superior in this respect to the action of a single shock depended upon in the Lucas method of geo-physical prospecting. Several times I happened to be in the street when a powerful explosion occurred somewhere, as might be caused by the bursting of a big pipe under pressure, blowing up of a boiler or short-circuiting of the electric power mains. In each case I found it impossible



to form a clear idea of direction and distance. But when a shrill whistle sounded the direction was unmistakable and I could even make a rough estimate of distance from the source. It is clear, therefore, that rapid periodic impulses are direction indicators better, by far, than single shocks. As a matter of fact, each separate impulse from my machine produces effects which are in every way identical with those of an explosion or dynamite and, except for the lack of energy, could be used like the latter in the investigation of subterranean strata and detection of ore deposits with the same chances of success. But a series of isochronous impulses can be enormously amplified by resonance so that their integral reaction is immensely greater than that obtainable by detonating a quantity of dynamite however large.

As will be readily inferred from the above energy equation any change of the amplitude and the velocity, which varies at the same rate, is accompanied by a relatively very great rise or fall of power. To illustrate, if the amplitude increased 16.7 percent the energy due to this would be augmented 33.4 percent and, owing to the rise in velocity, a further 66.8 percent so that the whole increase of energy would be  $66.8 + 33.4 = 100.2$  percent, that is to say, the power supply would have to be doubled. To give another example, if the amplitude were doubled, the power supply necessary for maintaining the oscillation would be twelvefold. But it should be pointed out that this relation







will not be true in some cases, namely, when the chambers do not permit a lengthening of the stroke of the plunger to that extent.

The task of perfecting a simple and efficient Tele-Geo-Dynamic transmitter was a very difficult one involving many years of work and great expense. During this time I developed three different types of these machines: an electrical, a composite, and one entirely mechanical. The first has certain advantages but is more complicated and further handicapped by the requirement of exactly adjusted accessories. The composite form embodies features of the electrical and mechanical in combination, is cheap, compact and convenient to operate. But the mechanical type excels the other two in all respects, is of ideal simplicity and operates with an efficiency of nearly one hundred percent. In view of this I am chiefly relying on its employment for prospecting and other ends.

A few words will be sufficient to convey a clear idea of the construction. The whole machine consists of only two parts: a stationary outer casing and a freely movable member within the same. The latter is a piston provided with ports and channels and fitted closely into the bore of an extension of the casing which has corresponding inlet and outlet openings for the admission and exhaust of the working fluid such as air. The casing contains a large accurately machined chamber divided in two airtight compartments by a fitting plunger carried on the shaft of the piston and firmly fastened to the same. One of the abutments





of the outer casing has a turned flange with bolt-holes for mounting it in vertical position on a foundation of stone, which should be bedrock if possible. Long and heavy barbed bolts are cemented in the foundation and to their protruding threaded ends the machine is solidly joined by massive checknuts.

Such a transmitter is almost perfect in the mechanical sense. It develops pressures of many tons which are necessary for the production of powerful reactions, operates without appreciable friction, requires no lubrication and is subject to no wear. When it is put in action, the rapid vibrations of the plunger alternately supply to and abstract heat from the inner walls of the chambers but owing to the quickness of these operations the absolute pressure of the gaseous medium in the chambers remains constant and the law of Mariotte, in regard to the inverse ratio of the pressures and volumes, holds rigorously true. This means that the device constitutes a frictionless indestructible spring performing absolutely isochronous oscillations, the period of which is determined by the elastic force of the gas and the mass set in motion. The power applied to the piston may alter to an extent the stroke of the plunger but can not have the slightest influence on the period. It would require a very great force to push the plunger back and forth in the chamber were it not that the impulses of the driving piston are in perfect resonance with the airspring, the plunger receiving, each time it passes the central position, a fresh push in the direction of its motion. Due to this a quite insignificant





pressure of the working fluid is sufficient to start the vibration.

The underlying principle involved in the transmission of energy by such an engine is the mutual reaction between its mobile and stationary parts and the reaction of the latter on a portion of the earth comprised within a distance equal to one-quarter of the wavelength. The displacements of the two parts and of the terrestrial region defined are inversely as the masses and since the mass of the region, compared with that of the reacting stationary part of the engine is immense, the displacements in the former are infinitesimal. Under these conditions the stresses engendered in the earth are so far below the elastic limit of the same that it behaves like a perfectly elastic medium and transmits the impressed impulses to any distance without loss. It would be impossible to impart great energy to the earth without resorting to resonance. The airspring, besides isochronizing the impulses, is a most effective means for achieving this by greatly increasing the amplitude and velocity of the mobile part of the engine. The superior efficiency of my transmitter would be, in itself, sufficient to give it a decided advantage over the means now employed but I accomplish something incomparably more important by precise adjustment of the constant of the airspring, the mass of the mobile part of the engine and the frequency or angular velocity of the impulses. In electric circuits only a moderate rise of the impressed force is realizable, but in a frictionless mechanical system as described I secure





infinite amplification which I limit by simple means to the maximum the engine can safely carry. In this way I collect in my receiving apparatus thousands of times more energy than can be derived from explosions of dynamite. The geo-physicist is thus provided with a new means of observation not unlike a microscope of transcendent resolving power which, after some experience, may yield wonderful results.

It was pointed out before that air is employed as working medium and it may be supplied under pressure to the intake of the engine, or else, suction may be applied to the exhaust of the same and the air permitted to be drawn into the intake. The latter plan has the advantage of ventilating the room enclosing the engine. However, in order to insure operation under all conditions, and also to extend the field of application of the transmitter, I provide an independent unit comprising a high speed electric motor of the "universal" type and, integral with it, a suction fan which may serve as blower, if desired. The motor can be energized by direct or alternating currents and, usually, the suction pipe of the fan will be joined to the exhaust of my engine. All the parts of the outfit work without lubricant. Of course, high speed machines produce a slight singing noise but I have devised means for securing complete silence. The scheme described permits the use of my transmitter throughout the country wherever electric current is available. Infinite amplification can be approximated in my receivers as well as transmitters and makes possible the employment of a very small unit, which may be carried in a handbag, for prospecting.



Lawyer, Industrialist (Pres. United States Steel) at diplomat, diplomat, and ~~president~~ president, United States Steel Corp. In a 17 page letter with diagrams <sup>dated July 26, 1931,</sup> (USS) dated July 26, 1931 (sent the Tube Museum archives by airmail to Nichols in the camp) Tish describes a process for degasifying, purifying, and refining steel. At that time Tish also made a similar proposal to the American Smelting and Refining Company (ASARCO) for the degasification of copper. The process ~~was~~ <sup>was</sup> ~~rejected~~ <sup>was</sup> by ASARCO. Amagami was entered into, and the process was refined to ~~be~~ called the "Tish Process." ¶ It is not known what approximate Tish received for these ~~methods~~ ~~inventions~~ ~~and~~ metal refining method. In fact the matter of exploits by machines, osalates, it became public knowledge that CONOCO used the method a number of years after Tish made the proposal to The Tube Co.

Lead action

④ June 4, 1907

Eighteenth class are, hum, present. Note the began word on page 13, "infinitive."  
The "infinitive" refers back to [2 and 2/2/80]



## COMMENTS ON TESLA'S TELEGEODYNAMICS PROPOSAL

### Background

This proposal was submitted by Nikola Tesla to The Texas Company in 1939. It is based on his Reciprocating Engine invention, U.S. Pat. No. 514,169, Feb. 6, 1894. A story, perhaps apocryphal, tells of Tesla causing a minor earth tremor in lower Manhattan, where he had established his laboratory, by clamping a small engine of this type to an I-beam and letting it find its own sympathetic resonance (Ref.: John O'Neill's biography of Tesla, *Prodigal Genius*).

In the article, "Nikola Tesla, Dreamer" (Allan L. Benson, *World Today*, Feb. 1912), an artist's illustration appears showing the entire earth cracking in half with the caption, "Tesla claims that in a few weeks he could set the earth's crust into such a state of vibration that it would rise and fall hundreds of feet and practically destroy civilization. A continuation of his process would, he says, eventually split the earth in two."

On the occasion of Tesla's annual birthday interview by the press July 10, 1935, in his suite at the Hotel New Yorker, he announced a method of transmitting mechanical energy accurately over any terrestrial distance, including a related new means of communication, and a method of locating deposits of minerals. He recalled the 'quake' in his laboratory that brought police and ambulances during experiments with a mechanical oscillator.

After the accident in 1935 when Tesla was hit by a taxicab, John O'Neill observed that Tesla seemed to suffer increasing periods of nonrationality. He attempted to protect <sup>him</sup> by censuring "letters to the editor" which ~~Tesla~~ <sup>he</sup> was prone to frequently communicate. O'Neill at that time was science editor of the New York Herald Tribune. ~~My concern is that this proposal may exhibit the~~ extravagant claims ~~written during a period of nonrationality.~~ *of this proposal may should be entertained in the context.*

### Comments on proposal

*Note*  
~~My first reaction to the paper is noting~~ that calculations of chemical reactions are carried out to six significant figures ~~entirely unnecessary and meaningless. Let's examine a matter in~~ Section I of the proposal where an error occurs.

On page 3, line 9, note that a calculation is presented of the temperature of a chemical reaction at constant pressure. The equation is expressed in English units and, therefore, the resulting temperature is in Fahrenheit. However, the Centigrade value is presented first despite the fact that it is a conversion value from the Fahrenheit value following it. (The significance of this will be pointed out below.)

*Reverse presentation*



proceed to page 6 where a similar calculation is presented of the temperature of a chemical reaction at constant volume. First note that a typo occurs for the coefficient of the "t" term of the equation on line 10. It should be the same as in the first term on the right side of the equation above, namely, 0.160414. In solving the quadratic equation by the well-known formula, Tesla obtains an incorrect value for the radical term, namely 19002.02. The correct value is 19401.13 (keeping Tesla's same number of significant figures).

This equation is as well expressed in English units. The correct value, 19401.13, results in a temperature "t" of 14839.9 degrees Fahrenheit. However, Tesla presents the temperature resulting from his 19002.02 error first as 14440.8 degrees Centigrade (it is actually in Fahrenheit) and then provides a conversion value, assuming it was Centigrade, to 266025.4 degrees Fahrenheit. (The hottest part of a crater of a carbon arc is 25 percent of this value, certainly known to Tesla, which should have suggested an error in calculation.) The presentation sequence in reverse causes problems here as noted two paragraphs above. The correct Centigrade value is 8326.39 degrees (again, keeping Tesla's number of significant figures).

The above miscalculations are not essential to the proposal as they are provided for illustrative purposes to give an indication of the energy involved in such chemical reactions.

Lacking geophysical knowledge, this writer is incapable of evaluating the merit of Section II. The running underscore at the top of page 13 is disturbing. Claims of "infinite" anything raise credibility questions.

Leland Anderson

August 12, 1996

In Section II we are presented with a method of employing isochronous impulses for locating ore deposits is presented. In a letter <sup>to Tesla</sup> dated April 19, 1918, Geo. Schaff refers to a newspaper article mentioning effects produced on seismographs in the county by the German "supergun" and recalls remarks ~~of Tesla~~ that seem to bear at what Tesla said some time before about mechanical transmitters of intelligence. On June 17, 1937, Schaff commented to Tesla the following:

The telegraphium proposed thus resuscitated. [IT should be noted that all ~~these~~ <sup>historical</sup> methods and techniques employed by mineral exploration and refinement enterprises are highly proprietary - <sup>Research</sup> ~~Research~~ into these subjects is therefore affront. Tesla made significant personal to Major Taylor, ~~1918~~



Lange, ~~Industrialist~~ (Pres. United States Steel) at ~~deplout~~, ~~deplout~~, at ~~his~~ ~~26~~, 1931,  
~~Pres~~ present, United States Steel Corp. In a 17 page letter with <sup>dated</sup> ~~describes~~ <sup>at</sup>  
(USS) dated July 26, 1931 (sent the Tish N. use arches ~~best~~ ~~made~~ ~~it~~ ~~shows~~ ~~in~~  
the copy) Tish describes a process for degasifying, purifying, and refining steel.  
At that time Tish also made a similar proposal to the American Smelting and  
Refining Company (ASARCO) for the degasification of copper. The process ~~was~~ <sup>is</sup> referred to  
by ASARCO. Amagami was entered into, and the process was referred to as  
called the "Tish Process." It is not known what company Tish used for these  
~~methods~~ ~~methods~~ ~~at~~ metal refining methods. In fact, the method of  
uplifts by, mechanical, or electrical, it became possible because that COMCO  
used the method a number of years after Tish used the proposal to Tish Steel Co.

See also

© June 4, 1947

Eighteen days ago, June, present. Note the beginning and on page 13, "in fact."  
The "in fact" refers back to [2 and 2/8/36]



Russia, at 70

Message Wave  
NY Herald

and the only new across the alarm  
building from utter collapse was the  
quick action of Dr. collapse was the  
a hammer

MECHANICAL THERAPY

IN FIVE

In order to convey a clear idea of the significance and revolutionary character of this discovery it is indispensable to make a brief statement regarding ELECTRICAL THERAPY.

Fifty years ago, while investigating high frequency currents developed by me at that time, I observed that they produced certain physiological effects offering new and great possibilities in medical treatment. My first announcement spread like fire and experiments were undertaken by a host of experts here and in other countries. When a famous French physician, Dr. D'Arsonval, declared that he had made the same discovery, a heated controversy relative to priority was started. The French eager to honor their countryman, made him a member of the Academy, ignoring entirely my earlier publication. Undesired to take steps for vindicating my claim, I went to Paris, where I met Dr. D'Arsonval. His personal charm disarmed me completely and I abandoned my intention, content to rest on the record. It shows that my disclosure antedated his and also that he used my apparatus in his demonstrations. The final judgment is left to posterity.

Since the beginning, the growth of the new art and industry has been phenomenal. Some manufacturers turning out daily hundreds of sets. Many millions are now in use throughout the world. The currents furnished by them have proved an ideal tonic for the human nerve system. They promote heart action and digestion, induce healthful sleep, rid the skin of destructive eruptions and cure colds and fever by the warmth they create. They vivify atrophied or paralyzed parts of the body, allay all kinds of suffering and save annually thousands of lives. Doctors in the profession have assured me that I have done more for humanity by this medical treatment than by all my other discoveries and inventions. Be that as it may, I feel certain that the MECHANICAL THERAPY, which I am about to give to the world, will be of incomparably greater benefit. Its discovery was made accidentally under the following circumstances.





- 8 -

I had installed at the laboratory, 35 South Fifth Avenue, one of my mechanical oscillators with the object of using it in the exact determination of various physical constants. The machine was bolted in vertical position to a platform supported on elastic cushions and, when operated by compressed air, performed minute oscillations absolutely isochronous, that is to say, consuming rigorously equal intervals of time. So perfect was its functioning in this respect that clocks driven by it indicated the hour with astronomical precision. One day, as I was making some observations, I stepped on the platform and the vibrations imparted to it by the machine were transmitted to my body. The sensation experienced was as strange as agreeable, and I asked my assistants to try. They did so and were mystified and pleased like myself. But a few minutes later some of us, who had stayed longer on the platform, felt an unspeakable and pressing necessity which had to be promptly satisfied, and then a stupendous truth dawned upon me. Evidently, these isochronous rapid oscillations stimulated powerfully the peristaltic movements which propel the food-stuffs through the alimentary channels. A means was thus provided whereby air contents can be perfectly regulated and controlled at will, and without the use of drugs, specific remedies or internal applications whatever.

When I began to practice with my assistants MECHANICAL THERAPY we used to finish our meals quickly and rush back to the laboratory. We suffered from dyspepsia and various stomach troubles, biliousness, constipation, flatulence and other disturbances, all natural results of such irregular habit. But after only a week of application, during which I improved the technique and my assistants learned how to take the treatment to their best advantage, all these forms of sickness disappeared as by enchantment and for nearly four years, while the machine was in use, we were all in excellent health. I cured a number of people, among them my great friend



Mark Twain whose books saved my life. He came to the laboratory in the worst shape suffering from a variety of distressing and dangerous ailments but in less than two months he regained his old vigor and ability of enjoying life to the fullest extent. Shortly after, a great calamity befell me: my laboratory was destroyed by fire. Nothing was insured and the loss of priceless apparatus and records gave me a terrific shock from which I did not recover for several years. The enforced discontinuance of MECHANICAL THERAPY also caused me deep regret. I had evolved a wonderful remedy for ills of inestimable value to mankind and invented apparatus offering unbounded commercial possibilities but when I came to consider practical introduction I realized that it was entirely unsuitable. It was big, heavy and noisy, called for a continuous supply of oil, part of which was discharged in the room as fine spray; it consumed considerable power and required a number of objectionable accessories. During the succeeding years I made great improvements and finally evolved a design which leaves nothing to be desired. The machine will be very small and light, operate noiselessly without any lubricant, consume a trifling amount of energy and will be, to my knowledge, the most beautiful device ever put on the market. The intention is to exhibit it in action at the occasion of my annual reception in honor of the Press which has been, unfortunately, delayed this year, and I anticipate that it will elicit great interest and receive wide publicity. Unless I am grossly mistaken it will be introduced very extensively and, eventually, there will be one in every household.

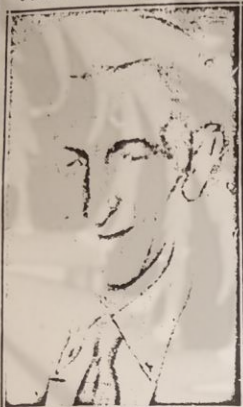
The practical application of MECHANICAL THERAPY through my oscillators will profoundly affect human life. By insuring perfect regularity of evacuations the body will function better in every respect



and life will become so much safer and more enjoyable. One of the most important results will be the great reduction -- amounting possibly to seventy-five per cent -- in the number of heart failures, which are usually caused by some acute upset of the digestive process and normal operation of the stomach. Another vital improvement will be derived from the quickened removal of toxic excretions of organs affected by disease. It is reasonable to expect that through this and other healthful actions ulcers and similar internal lesions or abscesses will be cured and relief might be obtained even in case of a cancer or other malignant growth. Skilled physicians and surgeons will be able to perform veritable miracles with such oscillations. They stimulate strongly the liver, spleen, kidneys, bladder and other organs and by these desirable actions they must contribute not a little to well being. Persons suffering from anemia of any form will be especially helped by the treatment. But the greatest benefit will be derived from it by women who will be able to reduce without the usual tantalizing abstinence, privation, sacrifice of time and money and torture they have to endure. They will improve much in appearance, acquire clear eyes and complexions and it may be safely predicted that long continued treatment will bring forth feminine beauty never seen before. It is not to be forgotten that the elimination of countless drugs, patent medicines and specific remedies of all kinds taken internally, by which millions of people doom themselves to an early grave, will be of untold good to humanity.



## 79th Birthday for Him



Herald Tribune photo—Zerbe  
Nikola Tesla

## Tesla, at 79, Discovers New Message Wave

*N.Y. Herald Tribune July 4, 1925*  
At Birthday Luncheon He Announces Machine for 1-Way Communication

Nikola Tesla announced yesterday, on his seventy-ninth birthday, the discovery of "the art of tele-geo-dynamics," or the propagation of mechanical impulses to the far ends of the earth, which can be used as an unfailing means of communication anywhere on the terrestrial globe, as a guide for ships at sea and as an indicator of where the mineral wealth of the world lies stored.

The machine by which this is accomplished was called by Dr. Tesla "my best achievement as an engineer." He spoke at a luncheon and press conference lasting six hours at the Hotel New Yorker. In addition, he disclosed his invention of an induction apparatus which provides direct current without commutators, a thing which he said "no competent engineer" would believe possible. Finally, the physicist and inventor propounded his beliefs as to cosmic rays, beliefs which were at material variance with Einsteinian physics.

The unveiling of these wonders was not done by demonstration of the machines or by presentation of mathematical proof. Dr. Tesla made his pronouncements as of facts accomplished which would be seen within the year. When asked for a demonstration, he refused to show his models or to tell where his laboratory work was done. All he would say was that he had a wealthy backer who would soon build a plant.

Of the direct-current motor without commutators, the scientist said he had shown the ambition of a life-

While discussing the views he had on cosmic rays, Dr. Tesla engaged in a metaphorical castigation of Dr. Albert Einstein and other exponents of the theory of relativity. The theory he called "a beggar, wrapped in purple, whom ignorant people took for a king," and its exponents "scientific fairy-tale spinners, rather than astronomers."

When pressed for a description of the effects which make up "the art of tele-geo-dynamics," Dr. Tesla likened the waves which his machine would originate and propagate through the earth to earthquake waves, only his waves were of much smaller amplitude. These waves lost little or

(Continued on page eight)

## Tesla, at 79, Discovers New Message Wave

*N.Y. Herald Tribune July 4, 1925*  
(Continued from page one)

none of their power with distance, he said. The greatest distance to which he had tried out the carrying power of the waves through the earth, he said, was six miles, but he felt sure they would reach to any point on the terrestrial globe. He emphasized the fact that they were mechanical and not electrical impulses, and that they were not intended for the transmission of power.

The first practical use which the tall, thin, almost cadaverous scientist envisioned for the waves is communication. It will matter not where a person is, on land or sea, if he is equipped with a small receiving set which he can carry in his pocket he will be able to hear messages sent from any part of the world. They are not instantaneous in passing through the earth, it requiring one hour and forty-nine minutes, according to Lord Kelvin, for an earthquake wave to go from one end of the earth to another. But this disadvantage is overcome by the advantage that there can be no possible interference by weather or static, Dr. Tesla says.

The second utility of the miniature earthquake waves is that they can guide a ship at sea with absolute precision. The tele-geo-dynamics machine, sending out waves from a certain fixed point, will resemble the center of infinite concentric circles traveling outward like the ripples in a pond where a stone has dropped. To keep on his course, the captain of a ship receiving these impulses has only to determine the angle at which the impulses strike the receiving set.

### Will Spot Minerals in Earth

Thirdly, the terrestrial wave machine will lay bare the physical interior of the globe, providing the means of locating whatever is of value beneath the surface, the inventor says. This is not a matter of echoes received from a dynamite blast, as used in geophysical exploration for oil and other minerals, but rather a tuned system which permits of qualitative differentiation between the various ores and elements underfoot.

A supplementary use for the machine could be found in time of war, said Dr. Tesla, in setting off bombs strategically placed and equipped with a receiving device.

In the course of his exposition, Dr. Tesla told of an early experiment in 1898 with a crude predecessor of tele-geo-dynamics machine in the neighborhood of 46 East Houston Street. He set the machine going and while

there was an earthquake, the Fire Department responded to an alarm frantically turned in, four tons of machinery flew across the basement and the only thing which saved the building from utter collapse was the quick action of Dr. Tesla in seizing a hammer and destroying his machine. The machine could be a Frankenstein's monster he confided, if not watched, since no substance can withstand steadily applied rhythm which finally reaches the resonance point of the substance. The Empire State Building, he said, could easily be destroyed with the steady building up of resonance from the timed strokes of a five-pound hammer.

### Loath to Describe Device

Dr. Tesla appeared extremely loath to describe his machine in any detail. A multitude of questions drew from him the information that it consisted of a cylinder of finest steel, suspended in midair by a type of energy which was old in principle but which had been amplified by a secret principle and a stationery part.

"I have found means for impressing upon the floating part," he said, "powerful impulses which react on the stationery part and, through it, transmit energy to the earth." That was about all he would say about it.

Dr. Tesla started to talk about his discoveries and theories soon after he had consumed a quart of hot milk, which he had considerable difficulty in getting served to him, the while his guests had a six-course luncheon topped off with a birthday cake supporting one candle. Dr. Tesla would not even touch the cake, saying that he feared to interfere with the ingrained habits of a lifetime: just drinking hot milk for luncheon and eating sparingly of vegetables for dinner. He spoke rapidly for two hours, dictating his findings for the most part, then yielded to the importunities of motion picture photographers to say a few words for the newsmen.

His new motor, Dr. Tesla confessed, was a stunt something like squaring the circle.

"The results which I have attained," he said in his high, constricted voice with quite a trace of accent from his native Serbia, "will be considered absolutely impossible by any competent electrical engineer. Ever since Faraday, we have had certain laws of induction which were considered absolutely inescapable. One of these is that when lines of force are linked with a circuit and electrical current is produced in the same, it was not possible to take those lines out of the circuit without inducing an equivalent flow of current in the opposite direction."

"Thousands of inventors and scientists have bucked against this difficulty in vain, and those who were the most competent never even tried to attain such a result, being convinced that experiments in that direction were useless. Now, incredible as it seems, I have found a solution of this old problem and not only am able to produce a current in one direction in



(Reprinted from *Nature*, Vol. 190, No. 4773, p. 374 only,  
April 22, 1961)

### Extra-Terrestrial Radio Transmissions

We are witness again to a surge of interest in, and speculation about, extra-terrestrial radio transmissions which had an earlier flare in the late 'twenties<sup>1</sup>. The favourable change in climate for the expression of such ideas since the turn of the century has been of particular interest to me. In 1899, Nikola Tesla established an experimental station at Colorado Springs, where he would be free to pursue certain electrical investigations, unrestrained by the limits imposed by his New York City laboratory. In an article by him<sup>2</sup>, published after his return to New York in the following year, he presented a rather thrilling account of signals received while alone one night in the experimental station:

"The changes I noted were taking place periodically, and with such a clear suggestion of number and order that they were not traceable to any cause then known to me. I was familiar, of course, with such electrical disturbances as are produced by the sun, Aurora Borealis and earth currents, and I was as sure as I could be of any fact that these variations were due to none of these causes. . . . It was some time afterward when the thought flashed upon my mind that the disturbances I had observed might be due to intelligent control. . . . The feeling is constantly growing on me that I had been the first to hear the greeting of one planet to another. . . . I announced to the Red Cross Society, when it asked me to indicate one of the great possible achievements of the next hundred years, that it would probably be the confirmation and interpretation of this planetary challenge to us."

I have acquired the original of Tesla's statement to the Red Cross Society, dated Christmas (January 7), 1900, which I believe is the first expression of the possibility of radio communication with other planetary communities. The announcement was harshly criticized. This was particularly unfortunate since, because of such attacks, Tesla never produced detailed information concerning the results of his intended investigations and the chance reception of signals.

LELAND I. ANDERSON

1615 East River Terrace,  
Minneapolis 14, Minnesota.

<sup>1</sup> Cocconi, G., and Morrison, P., *Nature*, **184**, 844 (1959). Bracewell, R. N., *Nature*, **186**, 670 (1960).

<sup>2</sup> Tesla, N., *Collier's Weekly*, **20**, No. 19, 4 (1901).



To the  
American Red Cross

New York City.

The retrospect is glorious, the prospect is  
inspiring: much might be said of both.  
But one idea dominates my mind. This -  
my best, my dearest - is for your noble cause.

I have observed electrical actions, which  
have appeared inexplicable. Faint and uncertain  
though they were, they have given me a deep  
conviction and foreknowledge, that ere long  
all human beings on this globe, as one, will  
turn the eyes to the firmament above, with  
feelings of love and reverence, thrilled by  
the glad news: "Brethren! We have a  
message from another world, unknown and  
remote. It reads: one ... two ... three ...

Christmas 1900

Nikola Tesla



NIKOLA TESLA  
(spiral nebula logo)  
NEW YORK

Hotel New Yorker  
September 11, 1935

George Sylvester Viereck Esq  
305 Riverside Drive  
New York.

My dear Viereck:

I hope you will excuse me for my seeming negligence in acknowledging your always welcome letters. But the circumstances which have confronted me of late were quite unusual.

Under enclosure I am returning your original interview which you had probably intended to correct. You did not get sufficient information from me in our short talk and, besides, the introduction would have placed me in a difficult position. We must be careful if we are to keep our hardearned reputations.

The few accompanying excerpts from the newspapers may interest you.

With best regards as ever

Yours very sincerely,

N. Tesla

-----

The interview referred to is I EXPECT TO TALK TO MARS. It was sold together with this letter by George A. Van Nosedall, an autograph dealer in New York city, to Lillian McChesney whose residence was on the ocean side of Long Island across from Tesla's Wardenclyffe installation. The interview article was intended to be published on the occasion of Tesla's 80th anniversary nine months later. The corrections on the manuscript are indeed in Tesla's hand. Tesla's concern about the introduction of the article probably focused on "inventor of the rotary motor" (incorrect, should have read "induction motor") and decorations which he may have been informed he would probably receive but, of course, had not as yet received. It is odd that Tesla would not have made the "induction motor" correction as well as suggesting a complete recast of the article on the point that it is based on Mars' distance of 10,000 light years from Earth.



*As revised by Tesla himself  
from the letter to Viceroy*

# I EXPECT TO TALK TO MARS

by

Nikola Tesla

As Told To

George Sylvester Viereck.

---

Nikola Tesla is the last of the Giants of the Electric Age. Civilization would not be what it is today if he had not discovered the Rotary Magnetic Field and invented the rotary motor. His fellows describe the venerable scientist as the "inventor's inventor." Recently, on the occasion of his 80th birthday, both the Serbian and the Yugoslav Governments honored Tesla with high decorations.

In 1899, while experimenting with a wireless receiver of extraordinary sensitivity, I detected faint signals from Mars, our brother planet. I could not interpret the signals, but they seemed to <sup>suggest</sup> ~~be~~ of a numerical code, one-two-three-four. The Martians, I assumed, used numbers in their attempts to communicate with the Earth because arithmetic constitutes a universal language.

In my attempts to elucidate the problem of these impulses from outer space, I received ridicule instead of co-operation. Other, more practical, problems monopolized my attention, but the idea of experimenting with inter-planetary communications never ceased to intrigue me. One reason for



severing my very pleasant relations with George Westinghouse and Thomas Edison, notwithstanding tempting propositions from both, was my desire to follow my own speculations in the great laboratory I built ~~at my own expense~~ in New Jersey.

Some of my discoveries and inventions have made electric history. They were practical devices, susceptible of commercial exploitation. But my chief recreation was to study the universe, and the place of the earth in the <sup>^</sup>starry system. Until man can talk in some manner with the inhabitants of other stars, he remains an earth-bound worm. My most recent discoveries, if verified by experience, will give wings to the earth-worm. To me, I trust, they will give abiding fame. The man who evolves a method of communicating with other planets, will be remembered in human annals after all present inventions are dipped in oblivion. I would willingly sacrifice all my other achievements to realize this dream. I am certain that I have found a solution theoretically beyond dispute.

I believe that my recent inventions, bearing upon this point, are more important than any of the seven hundred patents I previously gave to the world. Man reaches his maximum power in his old age, not in middle life. Every one should have a decade or so to sum up his life work after seventy-five. Every one would, if we lived sensibly. After man is seventy-five, he has gained so much experience that he can solve many problems that hitherto seemed insoluble. I hope, by systematizing my work and organizing the income and expenditure of my body with



scientific precision, to reach the ripe age of 140. Long before that, communication with Mars and other stars will have become practicable.

I do not envisage an Inter-planetary Post Office or an Inter-planetary Telephone Central. An imaginative friend of mine suggests that it will be possible to pick up a Tesla phone, dial Mars 2211, and speak to a friend on a distant planet. That, for reasons that will presently appear, is beyond the range of possibility. But it will be possible to flash a message to Mars and to receive some response from intelligent entities there. H. G. Wells, in an audacious short story, "Star-Begotten", advances the theory that the Martians, recognizing that they are living on a dying planet, are attempting to influence life on earth, with the object of reproducing themselves, so to speak metaphysically, in us. He insinuates that cosmic rays, directed from Mars, affect our genes, those carriers of human characteristics, and produce deviations in the human species important enough to create in time a new, more civilized human race. Mr. Wells forgets to tell that Mars is 10,000 light years away from the earth. If <sup>from Mars</sup> their rays are to affect the present generation of men, they must have been dispatched 10,000 years ago, when most of us were howling savages. Rays transmitted today (unless the Martians have anticipated my discovery) would affect men 10,000 years hence.

ANALYST  
Ms. A. 81

Folder



If a man wanted to ring up Mars, he would have to wait 10,000 years or more, because sound travels more slowly than light, before his voice could reach a listening ear. Even if his voice traveled with the speed of light, it would not reach the party at the other end of the line until the party making the call had been buried 10,000 years. Message and answer would fall on dead ears. That is one of the chief difficulties involved in inter-planetary communication. The movement of the stars, which makes it difficult for any impulse to reach a pre-defined spot, constitutes another difficulty.

Yet, I believe, that intelligent, sentient life exists on many planets, including Mars, and in universes revolving around ~~about~~ <sup>about</sup> suns more gigantic than ours. Mars, ~~it is generally believed,~~ in many respects resembles the earth, an earth grown old. It is logical to assume that the biological evolution of the Martians more or less <sup>parallels</sup> ~~resembles~~ that of the human species, although they may have reached a stage far in advance of ours. Their perception of the external world must correspond more or less to ours. They see, smell, feel, hear, live through the same senses as ~~man~~ <sup>we</sup>. ~~It~~ <sup>It</sup> is no strain on the imagination to assume some super-Tesla on Mars, perfecting at this very moment some new system of communication with us, since we have been deaf to all previous signals. But unless a revolutionary discovery enables the Martians and us to overcome the gap in time, both their and our present civilization will

Miss 481

Anderson, Leeland - Tesla's wireless - Article - "I expect to talk to Mars" - 1935, 1952, 1986

Box 7  
Folder 16



have perished before a message from one star to another can reach its destination.

Theoretically it might be possible to create some self-perpetuating body of scientists that would keep its ear glued to an inter-stellar telephone for ten times ten centuries; practically I fear it is out of the question. New nations, new mountain-ranges, new oceans, may be borne before the clock of the universe registers another ten thousand years.

Communication between two planets involves two essential conditions:

- 1) Coincidence in Time
- 2) Similarity of Evolution.

To meet the first condition, we must flash our message, not with the speed of light, the fastest at present known to science but, to all intents and purposes, instantaneously. To meet the second condition, it is essential that the inhabitants of the planets, with which we desire to establish some contact, have reached a phase of evolution similar, or superior to ours. There can be no intelligible or intelligent intercourse between an Amoeba and a Goethe or a Shakespeare.

It is safe to assume that somewhere in the universe, probably on Mars, the prerequisites for an interchange of ideas exists. But how can we meet the first condition? -- to overcome the handicap of distance and time? We need a force that transmits our message with infinite velocity. Unfortunately, the velocity of every known ray, however fast,



is finite. ~~I~~ I believe that I have circumvented the difficulty. My invention makes it possible to transmit enormous <sup>can</sup> amounts of energy through inter-planetary space and thousands of light years with practical instantaneity. With such a force it is possible to dispatch signals that can be detected by intelligent entities on other planets - now.

We need not flash the message directly to the other planet; we might use the moon as our writing pad, and inscribe our message on its pallid surface. The planetarians <sup>can</sup> could reply flash by flash to our communication, if they too have solved -- as I think they must have -- the problem of instantaneous transmission.

How?

The mathematics and physics are so intricate that it is impossible to explain my plan in language intelligible to the layman. For the present it must suffice to state that I use a new kind of energy and the combined resources of thirty-six highly technical inventions to beat the obstacle of time and space. The description of these inventions, even in technical symbols, would take a great deal of space. Fortunately the apparatus I have devised is small and compact. In spite of its modest size, it <sup>can</sup> flashes energy in considerable amount through interstellar space without loss or dispersion.

Other men will have to collaborate <sup>with me</sup> to work out in the details of the plan for interplanetary communication. I expect to confer with my friend George E. Hale, the great astronomist



of the Mount Wilson Observatory in Pasadena, California, who knows more about solar energy than any other human being, concerning the practical use of my apparatus in conjunction with his researches. In the meantime I shall submit to the Institute de France an accurate description of my devices, data and calculations, together with my claim for the prize of Fcs.100,000, offered by Pierre Guzman for the first communication with other worlds. ¶ I am convinced that the prize will be awarded to me because, I repeat, the problem is solved. The money is a trifling consideration, but for the great historical honor of being the first mortal to achieve the miracle of a planetary communication I would be almost willing to give my life. ~~for the greatest thing in history~~

Relativists may object that my efforts will be thwarted by what Einstein calls "the curvature of space". My own investigations based on a new dynamic theory of gravity demonstrate conclusively that space is not curved. According to the Relativists, space is distorted into curves by the influence upon it of celestial bodies. But the law of cause and effect is immutable. <sup>action induces a</sup> Every/Reaction. If the planets act upon space, space in turn reacts upon the planets. If the planets pull space out into curves, the counter-pull of space upon the planets neutralizes the effect, and straightens out the curves. Inasmuch as action and reaction are coexistent, the supposed curvature of space is a figment of the mathematical imagination.

The relativity theory, by the way, is much older than



its present proponents. It was advanced over two hundred years ago by my illustrious countryman Boscovich, the great philosopher who, not withstanding other and multifold obligations, wrote one thousand volumes of excellent literature on a vast variety of subjects. Boscovich dealt with relativity, including the so-called time-space-continuum, which enters into my calculations for inter-planetary calculations, masterfully and faultlessly. What he wrote was gold, compared with which the modern additions are dross.

My invention will carry my signals through space, curved or uncurved, with instantaneous precision. My statement will be attacked as fantastic. I am accustomed to that. It has happened to many of my ideas. But in most cases those who scoffed at first, eventually agreed with me -- if they lived long enough. I disagreed with Thomas Edison on the most effective electrical current. Edison championed the direct; I the alternating current. Events have justified my preference. Alternating currents are the life blood of industry today. Events will verify many of my predictions.

Even with our present limited knowledge, it is safe to venture certain prophesies. I visualize the whole earth as a huge brain in which before long all people will be able to communicate with each other through vest pocket radio equipments, sufficiently delicate to catch thought waves. Planes will be operated, newspapers printed, by wireless. Man will tap the eternal heat reserves of Mother Earth to run his machines; he will tame Vesuvius as he has (with the aid of one

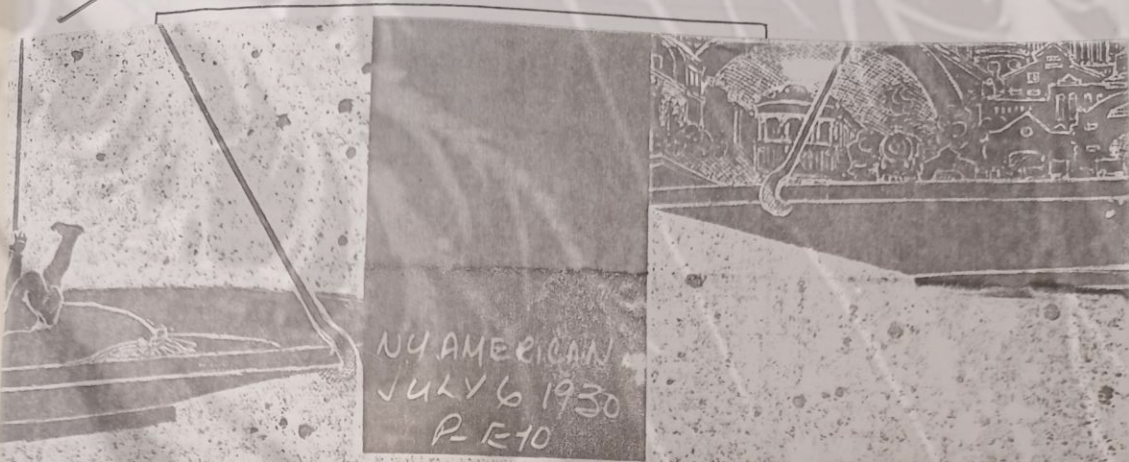


of my inventions) Niagara.

Most of the changes enlisted will come, because man will be able to transmit power, power gained not only from the earth but from the motion of the stars, and across vast distances; land, air and sea will be his carriers. All this is within sight of the present generation, the product of the imperfect human brain, But the imagination balks at the immense possibilities that will be open to man when, after perfecting my system of inter-planetary communications, he will be able to gather knowledge accumulated <sup>by intelligent beings</sup> on other stars.

---





## MAN'S GREATEST ACHIEVEMENT

By Nikola Tesla.

**W**HEN a child is born its sense-organs are brought in contact with the outer world.

The waves of sound, heat and light beat upon its feeble body, its sensitive nerve-fibres quiver, the muscles contract and relax in obedience: a gasp, a breath, and in this act a marvelous little engine, of inconceivable delicacy and complexity of construction, unlike any on earth, is hitched to the wheel-work of the Universe.

The little engine labors and grows, performs more and more involved operations, becomes sensitive to ever subtler influences and now there manifests itself in the fully developed being—Man—a desire mysterious, inscrutable and irresistible: to imitate nature, to create, to work himself the wonders he perceives.

Inspired to this task he searches, discovers and invents, designs and constructs, and enriches with monuments of beauty, grandeur and awe, the star of his birth.

He descends into the bowels of the globe to bring forth its hidden treasures and to unlock its immense imprisoned energies for his use.

He invades the dark depths of the ocean and the azure regions of the sky.

He peers into the innermost nooks and recesses of molecular structure and lays bare to his gaze worlds

infinitely remote. He subdues and puts to his service the fierce, devastating spark of Prometheus, the titanic forces of the waterfall, the wind and the tide.

He tames the thundering bolt of Jove and annihilates time and space. He makes the great Sun itself his obedient toiling slave.

Such is his power and might that the heavens reverberate and the whole earth trembles by the mere sound of his voice.

What has the future in store for this strange being, born of a breath, of perishable tissue, yet immortal, with his powers fearful and divine? What magic will be wrought by him in the end? What is to be his grandest deed, his crowning achievement?

Long ago he recognized that all perceptible matter comes from a primary substance, of a tenuity beyond conception and filling all space—the Akasa or luminiferous ether—which is acted upon by the life-giving Prana or creative force, calling into existence, in never ending cycles, all things and phenomena.

The primary substance, thrown into infinitesimal whirls of prodigious velocity, becomes gross matter; the force subsiding, the motion ceases and matter disappears, reverting to the primary substance.

Can Man control this grandest, most awe-inspiring of all processes

in nature? Can he harness her inexhaustible energies to perform all their functions at his bidding, more still—can he so refine his means of control as to put them in operation simply by the force of his will?

If he could do this he would have powers almost unlimited and supernatural. At his command, with but a slight effort on his part, old worlds would disappear and new ones of his planning would spring into being.

He could fix, solidify and preserve the ethereal shapes of his imagining, the fleeting visions of his dreams. He could express all the creations of his mind, on any scale, in forms concrete and imperishable.

He could alter the size of this planet, control its seasons, guide it along any path he might choose through the depths of the Universe.

He could make planets collide and produce his suns and stars, his heat and light. He could originate and develop life in all its infinite forms.

To create and to annihilate material substance, cause it to aggregate in forms according to his desire, would be the supreme manifestation of the power of Man's mind, his most complete triumph over the physical world, his crowning achievement which would place him beside his Creator and fulfill his ultimate destiny.



### TESLA ON MIND AND MATTER

ON MAY 13, 1907, Nikola Tesla wrote the following note to the "Actor's Fund Fair" on Man's Greatest Achievement. The text is transcribed from an A.L.S. in the collections of the Bakken Library of Electricity in Life.

To the Actor's Fund Fair

May 13, 1907

#### Man's Greatest Achievement.

When a child is born its sense-organs are brought in contact with the outer world. The waves of sound, heat and light, beat against its feeble body, its sensitive nerve-fibers quiver, the muscles contract and relax in obedience: A gasp, a breath, and in this act a wonderful little engine, of inconceivable delicacy and complexity of structure, is hitched to the wheel-work of the universe.

The little engine moves and works, changes size and shape, performs more and more involved operations, becomes sensitive to ever more complex influences and now--there manifests itself in it a mysterious force. Slowly, by imperceptible steps, the engine has been transformed into a being possessed of intelligence.

The responsiveness increases, fast multiply the experiences, a finer sense is developed, the creature awakes to the consciousness of Nature and its grandeur and in its breast is kindled the desire, to work itself the wonders it perceives.

But the exercise of this power alone does not satisfy the mind and Man, reaching out to the stars with his invisible feelers, rises to still loftier desires, to still higher undefinable perceptions, and inspired by them the artist, the inventor, the men of science, give expression to the longing of the human soul.

What could he, born of breath accomplish, what would be most consequential--his greatest deed?

(Continued overleaf)

*But the exercise of this power alone does not satisfy the mind and Man reaching out to the stars with his invisible feelers, rises to still loftier desires, to still higher undefinable perceptions, and inspired by them the artist, the inventor, the men of science, give expression to the longing of the human soul.*



(Tesla on Mind and Matter, continued)

Every particle of matter is composed of a primary substance—the ether—filling all space. The atom of any elementary body is differentiated from the rest of this tenuous substance merely by a spinning motion like a whirl in a calm lake. By being set in movement ether becomes palpable matter; the movement arrested, the primary substance reverts to its normal state and becomes imperceptible. It appears, then, possible for Man, by refrigerating machines or other means for arresting ether movement, and electrical or other forces for forming ether whirls, to annihilate or to create all kinds of ponderable matter. By harnessing the Sun's energy these processes might be made to go on automatically, without his intervention other than wilful control. At his command, almost without effort on his part, old worlds would disappear and new ones spring into being. He could alter the size of this planet, control its seasons, adjust its distance from the Sun, guide it on its eternal journey, along any path he might choose, through the depths of the Universe. He could cause planets to collide and produce his own Suns and stars, his heat and light. He could originate life in all its infinite forms.

To create and to annihilate material substance, to cause at his will its birth or its death, would be Man's most consequential deed—his greatest achievement, which would place him beside his Creator, make him fulfil his ultimate destiny.

Nikola Tesla

This letter formed the basis of an article entitled "Man's Greatest Achievement" which appeared in the New York Sunday American July 6, 1930.





Lee: I'll ask Dobson to send the books he referred to. Best,

*Lee*

# THE SAN FRANCISCO SIDEWALK ASTRONOMERS

September 14<sup>th</sup> 1984

## Board of Directors

Gerard Pardeilhian  
Ruth Ballard  
Mark Leet  
Douglas Snyder  
Joseph Pattin

Founder and Advisor  
to the Board  
John L. Dobson

Dear Margaret Cheney,

I found your letter here when I got back from Canada. Thank you!

Please tell your friend (Lee Anderson) that I don't find anything wrong with Tesla's celestial mechanics, but statements 1) + 2) are really the same thing. Kinetic energy goes up as the square of the velocity ( $\frac{1}{2}mv^2$ ); so if we increase the velocity of an object by  $\sqrt{2}$  we double its kinetic energy.

What Tesla is telling us is that if we double the ~~kinetic~~ kinetic energy of a body in orbit it will have what we call "escape velocity" i.e. the gravitational field of its companion will be insufficient to cause it to fall back. ~~And~~ Although the ~~grav~~ kinetic energy will fall off with distance so will the gravitational field from which it has escape velocity.

Why Tesla felt that that shows the irrationality of harnessing atomic energy ~~and~~ ~~probably~~ is not clear. Most probably it is related to his mental picture of the atom. It sounds as though he has nuclear energy associated with the "orbiting" electrons, which of course it is not. It is related to Heisenberg's uncertainty principle, and it is very doubtful (in my mind) that Tesla (way back then) understood that point.

(over)

1600 BAKER ST. SAN FRANCISCO, CALIFORNIA 94115 (415) 567-2063 771-0919



MS 481

As to where, in Swami Vivekananda's letter, the passage about Tesla (and Prana and Akasha) occurs, I found in Chicago, when I was writing, to you, that in the recent editions of Swamiji's Complete Works (which I don't have) the reference page has changed from the older edition. I believe that in the first letter I wrote you and I no longer have it at my finger tips. The reference page in my edition is vol. I, p. 77. That is the page I referred to in Advaita Vedanta and Modern Science.

Did I ever send you a copy of that book? And did I ever send you a copy of "Einstein and Vivekananda" or of "Einstein's Physics of Illusion"?

I'm looking forward to meeting you again sometime when we go up that road to Tremont Peak. By the way, did you know that Coulter Optical Co. is named for the Coulter firm up there? Jim Jacobson used to live in Hollister.

Thanks again,

John C. Wilson

Folger 17



# SPECIAL REPORT

ASTRONOMY

## Instrument improvements will yield greater detail in new star survey

A NEW survey of the entire northern sky, conducted by astronomers at California Institute of Technology's Mt. Palomar Observatory near San Diego, will be valuable to astronomers and navigators in a number of ways, according to Dr. Gerry Neugebauer, director of the observatory.

This will be the second survey of its type using Mt. Palomar's 48-in. (1.2-m) Schmidt telescope. The telescope was first used to map the northern sky in the early 1950s. In upgraded and refurbished form, it will be employed in a 5-yr survey that will result in the most precise mapping of the region ever accomplished.

Data will complement a similar survey of the southern sky being completed by an Australian team using the UK Schmidt telescope, which is identical to Mt. Palomar's.

Discussing some of the improvements to the Mt. Palomar instrument, team member Dr. James Schombert said, "The main change is that we have a better corrector lens. Lens makers have developed new types of 'Pyrex' glass with better properties," he told R&D.

The new lens avoids the image-blurring phenomenon, chromatic aberration. "Such blurring occurs . . . because, although the lens focuses light of one wavelength sharply, longer or shorter wavelengths are refracted differently and, thus, do not focus well. The new lens, consisting of two pieces of special glass cemented together and ground to a complex surface, can sharply focus light throughout the visible range and into the near infrared," Schombert explained.

Equally important for gaining much more accuracy and information is the availability of vastly improved photographic film emulsions compared to those used in the first survey. "With these improvements," Schombert said, "our new survey will be much deeper in terms of limiting magnitudes."

"The mirror and aperture will be the same size, but we'll have much faster emulsions . . . so we'll be able to get a longer exposure time allowing detection of fainter objects, and the emulsions will have a much finer grain structure so we will have better resolution. This will contribute to a much better 'signal-to-noise' ratio than before."



Improvements to the 48-in. Schmidt telescope at Caltech's Palomar Observatory are expected to provide a much more detailed survey of the northern sky. This is the second time the Schmidt telescope has been used to survey the northern sky (the first was in the 1950s), and it should become a valuable tool for astronomers and space scientists.

During good viewing nights, astronomers and technicians will photograph fields of about 6.5 deg across (about 13 times the size of the moon in the full sky) on a 14-in.-square (36-cm) glass photographic plate.

Each plate will be exposed for about 60 min. as the telescope holds position by homing in on a bright guide star in the field. After exposure, the plate will be developed and examined for quality and to spot any "short-time phenomena" such as supernovas, comets, and asteroids.

The astronomers plan to obtain images of 894 fields using plates coated with three different emulsions that react to blue, red, or near-infrared light. Once the information has been processed, it will be used in a variety of ways.

One of the immediate applications will be to provide information for the U.S. space telescope, now scheduled to be placed into orbit by the end of 1988.

"That telescope will need to have stars it can point to accurately to perform its mission, and our survey will provide

such star data anywhere in the northern sky. Our results will be made available to a project group at TRW Inc. and to members of the Space Telescope Institute," Schombert said.

Comparisons of star positions from the new and old surveys also will help map the structure and circulation of the galaxy. "One of the great benefits of this situation is the large baseline it offers," Schombert said.

"The only way to accurately determine the distance to a star is to wait a long time and get new position data. There is some stellar motion every year, but it's very small. But after 30 years, that movement is much more noticeable."

"An example of what this can mean is the relation of the position of Earth and our Sun to the center of the galaxy. At present this is in error on the order of plus or minus thousands of light-years. Comparing data from the two surveys should help us pin down that relationship much more precisely," he explained.

"If we know the motions of the stars

RESEARCH & DEVELOPMENT—FEBRUARY 1987 93

1600 BAKER ST. SAN FRANCISCO, CALIFORNIA 94115 (415) 567-2063 771-0919



Lee: I'll ask Dobson to send the...



Merle Sweet, a technician at Mt. Palomar Observatory, inspects one of the nearly 900 photographic plates that eventually will make up the survey of the northern sky.

and their orbital parameters, and if we can get a good numerical model, it can be combined with other types of data to gain fresh insights. We hope the survey will complement data from radio astronomy, x-ray astronomy, infrared astronomy,

and space telescope information to expand our scientific knowledge about the universe."

From a scientific standpoint, the study could reveal completely unexpected phenomena. This already happened in a

small way in August when a first look at a field photograph from the upgraded system disclosed a new comet.

The comet, Comet Wilson—named after its discoverer, Christine Wilson, a Caltech graduate student—is as large as Halley's Comet, and will be visible to the naked eye in the southern hemisphere next August.

As the work continues, much more dramatic finds are foreseen. "When you survey the entire sky as we're doing, there's a chance you'll find new types of galaxies or star clusters or even something that we haven't seen before," Schombert said.

One of the things the team is thankful for is that they were able to persuade the city of San Diego to install a type of yellow streetlight that limits interference with sky viewing (*R&D* April 1984, p 76). However, Schombert said, "Even with San Diego's choice of the preferred lights, sky glow remains a problem."

"We still have an ongoing problem because the population keeps increasing and we are affected by lighting in other places including Riverside and Palm Springs. In five years, it seems certain the problem will be much worse than it is now," he said. □

## Ambitious TAU project would send a spacecraft into deep space to obtain data on stars and galaxies

A TEAM OF researchers at NASA's Jet Propulsion Laboratory, Pasadena, CA, is working on a spacecraft designed for interstellar travel.

The TAU (thousand astronomical units) Project to achieve this deep space exploration will rely on a number of emerging technologies, according to Dr. Lew Allen of JPL, who conceived the mission. Allen asked Aden and Marjorie Meinel (a husband and wife astronomer team) to organize studies of possible TAU systems. Although work on TAU is being carried out by JPL researchers, the program is not yet a NASA project.

Primary goal of the project is to obtain more-accurate data on the distances of stars and galaxies, as well as measure properties of interstellar space. The voyage itself could take 50 to 100 yr to complete and the spacecraft would travel some 100 billion mi ( $1 \times 10^{11}$  mi).

Keys to the success of the mission include the use of an ion propulsion system, a 1-MW nuclear reactor, and an optical laser communications system. To attain the high speeds to make this type of mission practical, preliminary designs have relied on the use of an ion propulsion system.

An ion engine typically puts out a small amount of thrust at a constant rate, which in the vacuum of space would steadily increase acceleration until very

high velocities are achieved. Aden Meinel said that these engines can achieve a velocity 40 times greater than that attained with the chemical propulsion system used to launch the space shuttle.

He reported that JPL researchers have performed ground tests on a small ion engine that they want to use in a proof-of-concept lunar mission in the

next two years.

Marjorie Meinel told *R&D*, "Present plans call for using 10 ion engines (fueled with solid xenon propellant) fired in pairs for 2 yr/pair. This would give us a total firing time of about 10 years, after which the spacecraft would be well beyond the outermost planet."

A 1-MW nuclear reactor would provide energy to electronically accelerate a

## Telescope's greatest asset is viewing time

ASTRONOMERS have started to use a new 94-in. telescope that can capture the faintest glimmers of light at the edge of the observable universe. The telescope is located atop Arizona's Kitt Peak.

The \$2 million instrument, owned jointly by Dartmouth College, Massachusetts Institute of Technology, and Univ. of Michigan, will take some of the pressure off national telescope facilities.

"The national telescopes are hard to get time on; they're highly competitive," said Todd Boroson, director of the McGraw-Hill Observatory, the consortium that operates the telescope.

"You have to schedule time far in advance, and usually very conservative proposals are the ones that get approved. Discoveries are more likely to be made on

our new telescope because you can look at things [managers of the] national telescopes would not allow," Boroson added.

The new telescope uses a primary mirror to capture light from objects under study and then reflects that light to a smaller mirror located above it. Light from the small mirror bounces back to the center of the primary mirror and into a 1-cm<sup>2</sup> charge-coupled device that contains roughly 1 million tiny light detectors. Data from the CCD are fed directly to a computer.

Initial studies using the telescope, Boroson said, will concentrate on the nature and classification of quasars, and the shapes and distribution of galaxies. □



03-05-91

## NIKOLA TESLA'S NOVEMBER 11, 1934 STATEMENT ON MATTER AND FORCE

"Matter cannot be destroyed, nor can it be created. But this statement must be qualified. When Chaos "the terrific mother" begot from "stark Eternity" an universe of form and order, there was no change in the quantity of matter provided that this term also includes the ether. Heretofore its meaning in philosophical works was restricted to things perceptible and the above time-honored scientific dictum is false, for gross matter is ever changing in amount being continuously produced from ether and again dissolved into the same. In the last analysis, the entire universe consists of ether which cannot be created or destroyed and, consequently, remains eternally constant in quantity. I have made a discovery of inestimable importance in this connection and verified it in striking experiments.

"Lord Kelvin was emphatic in his utterances that the ether exists but the Relativists have discarded this active medium indispensable to the Newtonian interpretation of the Cosmos. They have even strayed so far from rational concepts as to believe in the interchangeability of matter and force. This is the rankest nonsense, of course. It is like saying that the body can be transformed into the soul or vice versa. The soul, spirit, or mind are but expressions of the functioning of the body and cease in death. Exactly so, force is the result of the motion of matter. If all motion were to stop, gross matter would disappear."

/N. Tesla/

From the Teslaiana collection of  
Leland I. Anderson



03-05-91

## THE ETHEREAL SOURCE OF THE ENERGY OF THE UNIVERSE

A little over one century ago many astronomers, including Laplace, still thought that the system of heavenly bodies was unalterable and that they would perform their motions in the same manner through all eternity. But the gradual perfection of instruments and refinement of methods of investigation, achieved since that time, has led to the recognition that there is a continuous change going on in the celestial regions subjecting all bodies to ever varying influence. Where this change is leading to, and what is to be its final phase, have become questions of supreme scientific interest. In a communication to the Royal Society of Edinburgh dated April 19, 1852 and the Philosophical Magazine of October of the same year, Lord Kelvin drew attention to the general tendency in nature towards dissipation of mechanical energy, a fact borne out in daily observation of thermo-dynamic and dynamo-thermic processes and one of ominous significance. It meant that the driving force of the universe was steadily decreasing and that ultimately all of its motive energy will be exhausted - none remaining available for mechanical work. In the macro-cosmos, with its countless suns and stars, each of dimensions and energy beyond conception, this process might require billions of years for its consummation; but in the infinitesimal worlds of the micro-cosmos it must have been quickly completed. Such being the case then, according to all experimental findings and deductions of positive science, any material substance, cooled down to the absolute zero of temperature, should be devoid of all internal movement and energy, so to speak, dead.

This idea of the great philosopher, who later honored me with his friendship, had a fascinating effect



on my mind and in meditating over it I was struck by the thought that if there is energy within the substance it can only come from without. This truth was so manifest to me that I expressed it in the following axiom: "There is no energy in matter except that absorbed from the medium." Lord Kelvin gave us a picture of a dying universe, of a clockwork wound up and running down, inevitably doomed to come to a full stop in the far, far off future. It was a gloomy view, incompatible with artistic, scientific and mechanical sense. I asked myself again and again, was there not some force winding up the clock as it runs down? The axiom I had formulated gave me a clue. If all energy is supplied to matter from without then this all important function must be performed by the medium. Yes - but how? I pondered over this oldest and greatest of all riddles of physical science a long time in vain, despairingly reminded of the words of the poet:

"Wo fass ich dich, unendliche Natur?  
Euch Bruste wo Ihr Quellen alles Lebens  
An denen Himmel und Erde hangt. . . " \*

What I strove for seemed unattainable, but a kind fate favored me and a few inspired experiments lifted the veil. It was a revelation wonderful and incredible explaining many mysteries of nature and disclosing, as in a lightning flash, the illusionary character of some modern theories, incidentally also bearing out the universal truth of the above axiom.

When radio-active rays were discovered their investigators believed them to be due to liberation of atomic energy in the form of waves. This being im-



possible in the light of the preceding I concluded that they were produced by some external disturbance and composed of electrified particles. My theory was not seriously taken although it appeared simple and plausible. Suppose that bullets are fired against a wall. Wherever a missile strikes the material is crushed and spatters in all directions radially from the place of impact. In this example it is perfectly clear that the energy of the flying pieces can only be derived from that of the bullets. But in manifestations of radio-activity no such proof could be advanced and it was, therefore, of the first importance to demonstrate experimentally the existence of this miraculous disturbance in the medium. I was rewarded in these efforts with quick success largely because of the efficient method I adopted which consisted in deriving from a great mass of air, ionized by the disturbance, a current, storing its energy in a condenser and discharging the same through an indicating device. This plan did away with the limitations and incertitudes of the electro-scope first employed and was described by me in articles and patents from 1900 to 1905. It was logical to expect, judging from the behavior of known radiations, that the chief source of the new rays could be the sun, but this supposition was contradicted by observations and theoretical considerations which disclosed some surprising facts in this connection.

Light and heat rays are absorbed in their passage through a medium in a certain proportion to its density. The ether, although the most tenuous of all substances, is no exception to this rule. Its density has been first estimated by Lord Kelvin and conformably to his finding a column of one square centimeter cross section



and of a length such that light, travelling at a rate of three hundred thousand kilometers per second, would require one year to traverse it, would weigh 4.8 grammes. This is just about the weight of a prism of ordinary glass of the same cross section and two centimeters length which, therefore, may be assumed as the equivalent of the ether column in absorption. A column of ether one thousand times longer would thus absorb as much light as twenty meters of glass. However, there are suns at distances of millions of light years and it is evident that virtually no light from them can reach the earth. But if those suns emit rays immensely more penetrative than those of light they will be but slightly dimmed and so the aggregate amount of radiations pouring upon the earth from all sides will be overwhelmingly greater than that supplied to it by our luminary. If light and heat rays would be as penetrative as the cosmic, so fierce would be the perpetual glare and so scorching the heat that life on this and other planets could not exist.

Rays in every respect similar to the cosmic are produced by my vacuum tubes when operated at pressures of ten millions of volts or more, but even if it were not confirmed by experiment, the theory I advanced in 1897 would afford the simplest and most probable explanation of the phenomena. Is not the universe with its fiery suns electrodes at temperatures far beyond any we can apply in the puny and crude contrivances of our making? Is it not a fact that the suns and stars are under immense electrical pressures transcending any that man can ever produce and is this not equally true of the vacuum in celestial space? Finally, can there be any doubt that cosmic dust and meteoric matter



present an infinitude of targets acting as reflectors and transformers of energy? If, under ideal working conditions, and with apparatus on a scale beyond the grasp of the human mind, rays of surpassing intensity and penetrative power could not be generated, then, indeed, nature has made an unique exception to its laws.

New York, October 13, 1932

/ Nikola Tesla /

-----  
\* Goethe's Faust, lines 455-57:

Where can I grasp ahold of you, eternal nature?  
You suckle like the source of all life,  
On which the heavens and earth are fastened.

(Translation by Alex von Furstenberg)

abet  
lery  
rait G

h. c  
the  
on  
ly c  
Vill  
ght  
ty  
cen  
part  
los  
mis  
nd.  
ovec  
the  
rsity  
h,"  
ind  
ow,  
an  
at,  
th  
lthe  
riti  
ene  
bli  
rier  
er's  
ions  
lowi  
; Un  
845  
' G  
tion  
richt  
wer  
ion  
on v  
the  
ctia  
tica  
phil  
fath  
cam  
ie a  
o it  
rem

n a  
Gal  
hys  
elec



HOTEL NEW YORKER

1939

A STORY OF YOUTH TOLD BY AGE

DEDICATED TO

MISS POLA FOTITCH

BY ITS AUTHOR

NIKOLA TESLA

My dear Miss Fotitch:

I am forwarding to you the "Calendar of Yugoslavia" of 1939 showing the house and community in which I had many joyful and sad experiences and odd adventures and in which also, by a coincidence bizarre, I was born. As you may see from the photograph on the sheet for June, the old-fashioned building is located at the foot of a wooded hill called Bogdanić. Adjoining it is a church and behind it a little further up a graveyard. Our nearest neighbors were two miles away and in the winter, when the snow was six or seven feet deep, our isolation was complete.

My mother was indefatigable and worked regularly from four o'clock in the morning till eleven in the evening. From four to breakfast time, 6 A.M., while others slumbered, I never closed my eyes but watched my mother with intense pleasure as she attended quickly - sometimes running - to her many self-imposed duties. She directed the servants to take care of all domestic animals, milked the cows, performed all sorts of labor unassisted, set the table, prepared breakfast for the whole household and only when it was ready to be served did the rest of the family get up. After breakfast everybody followed by mother's inspiring example. All did their work diligently, liked it and so achieved a measure of contentment. But I was the happiest of them, the fountain of my enjoyment being our magnificent Maćak - the finest of all cats in the world. I wish that I could give you an adequate idea of the depth of affection which existed between me and him. You would look vainly in the mythological and historical records for such a case. We simply lived one for the other. Wherever I went Maćak followed primarily owing to our mutual love and then again moved by the desire to protect me. When such a necessity presented itself he would rise to twice his normal height, buckle his back and with the tail as rigid as a metal bar and whiskers like steel wires he would give vent to his rage by explosive puffs Pfftt! Pfftt! It was a terrifying sight and whatever provoked him, human being or animal, beat a hasty retreat.



In the evening we went through our usual program. I would run from the house along the church and he would rush after me and grab me by the trousers. He tried hard to make me believe that he would bite, but the instant his needle sharp incisors penetrated the clothing the pressure ceased and their contact with my skin was as gentle and tender as that of a butterfly alighting on a petal. He liked best to roll on the grass with me. While we were doing this he bit and clawed and purred in rapturous pleasure. He fascinated me so completely that I too bit and clawed and purred. We just could not stop and rolled and rolled and rolled and rolled in a delirium of delight. We indulged in this enchanting sport day by day except on rainy weather. In respect to water Mačak was very fastidious. He would jump six feet to avoid wetting his paws. On such occasions we went into the house and, selecting a nice cosy place, abandoned ourselves for each other in affectionate embracement. Mačak was scrupulously clean, had no fleas or bugs whatever, shed no hair and showed none of the objectionable traits and habits of cats as I knew them later. He was touchingly delicate in signifying his wish to be let out at night and scratched the door gently for readmittance.

Now I must tell you of a strange and unforgettable experience which bore fruit in my later life. Our home is about eighteen hundred feet above sea level and in the winter we had dry weather as a rule, but sometimes it happened that a warm wind from the Adriatic would blow persistently for a long time, melting rapidly the snow, flooding the land and causing great loss of property and life. We would then witness the terrifying spectacle of a mighty seething river carrying wreckage and tearing down everything moveable in its way. Since I often visualize the events of my youth to find relief from great and dangerous mental strain and when I think of the scene the roar of the waters fills my ears and I see as vividly as then, their tumultuous flow and the mad dance of the wreckage. This leaves me, for a while, sad and depressed. But always agreeable are my recollections of winter with its dry cold and snow of immaculate white.

It happened that on the day of my experience we had a cold drier than ever observed before. People walking in the snow left a luminous trail behind them and a snowball thrown against an obstacle gave a flare of light like a loaf of sugar hit with a knife. It was dusk of the evening and I felt impelled to stroke Mačak's back. Mačak's back was a sheet of light and my hand produced a shower of sparks loud enough to be heard all over the place. My father was a very learned man, he had an answer for every question. But this phenomenon was new even to him. Well, he finally remarked, this is nothing but electricity, the same thing you see on the trees in a storm. My mother seemed alarmed. Stop playing with the cat, she said, he might start a fire. I was thinking abstractedly. Is nature a gigantic cat? If so, who strokes its back? It can only be God, I concluded. You may know that Pascal was an extraordinarily precocious child who attracted attention before he reached the age of six years. But here I was, only three years old, and already philosophising!

I can not exaggerate the effect of this marvellous sight on my childish imagination. Day after day I asked myself what is electricity and found no answer. Eighty years have gone by since and I still ask the same question, unable to answer it. Some pseudo scientist of whom there are only too many may tell you that he can, but do not believe him. If any of them knew what it is I would also know and the chances are better than any of them for my laboratory and practical experiences are more extensive and my life covers three generations of scientific research.



My childhood in Mačak's delightful company and undying friendship would have passed blissfully if I did not have a powerful enemy, relentless and irreconcilable. This was our gander, a monstrous ugly brute, with a neck of an ostrich, mouth of a crocodile and a pair of cunning eyes radiating intelligence and understanding like the human. I aroused his ire by throwing pebbles at him, a most foolish and reckless act which I bitterly regretted afterwards. I liked to feed our pigeons, chickens, and other fowl, take one or the other under my arm and hug and pet it. But the brute would not let me. The moment I entered the poultry yard he would attack me and as I fled grab me by the seat of my trousers and shake me viciously. When I finally managed to free myself and run away he would flap his huge wings in glee and raise an unholy chatter in which all the geese joined. When I grew up two aunts of mine used to tell me how I answered certain questions they asked. One was Aunt Veva who had two protruding teeth like the tusks of an elephant. She loved me passionately and buried them deep in my cheek in kissing me. I cried out from pain but she thought it was from pleasure and dug them in still deeper. Nevertheless I preferred her to the other aunt whose name has slipped from my memory and she used to glue her lips to mine and suck and suck until by frantic efforts I managed to free myself gasping for breath. These two aunts amused themselves by asking me all sorts of questions of which I remember a few. Are you afraid of Luka Bogić? No! Luka always carried a gun and threatened to shoot. He robbed other boys of pennies and gave them to me. Are you afraid of the cow? No! That was one of our cows and very nice until one day I slid from a fence on her back for a ride when she made off with me bellowing and threw me. I was none the worse for the experience. Are you afraid of the bad wolf? No! No! This was the wolf I met in the woods near the church. He was looking at me fixedly and approaching slowly. I shouted as usual when a wolf is around and he trotted away slowly. My present visualization of this scene is astonishingly sharp and clear. After a number of such questions one of the aunts asked me; Are you afraid of the gander? Yes! Yes! I replied emphatically, I am afraid of the gander! I had good reason to be. One summer day my mother had given me a rather cold bath and put me out for a sun warming in Adam's attire. When she stepped in the house the gander espied me and charged. The brute knew where it would hurt most and seized me by the nape almost pulling out the remnant of my umbilical cord. My mother, who came in time to prevent further injury, said to me: "You must know that you can not make peace with a gander or a cock whom you have taunted. They will fight you as long as they live." But now and then I would play in the poultry yard to my heart's content for on certain days our geese, led by the gander, rose high in the air and flew down to the meadow and brook where they sported like swans in the water and probably found some food. I would then feed and pet the pigeons, the poultry and our grand resplendant cock who liked me. In the evening the gander brought back his flock who made a few turns above the house and then came down with a deafening noise. The sight of the flying geese was a joy and inspiration to see.



MS 981

Folder 21

1939  
Tesla:  
"A Story of Youth Told by Age"  
Dedicated to Miss Pola Fotitch,  
daughter of Dr. Constantine Fotitch  
Yugoslav Ambassador to the U.S.  
who led the procession of mourners  
past Tesla's coffin. At that time,  
Sava Kosanovich, Tesla's nephew,  
who was chief mourner, was Minister  
of State of Yugoslavia.

Source:  
Smithsonian Institution  
Archive for the History of Elec-  
trical Science and Technology

*Smead*  
No. 153L

HASTINGS, MINN. - LOGAN, OHIO U.S.A.



of German was very good. German was one of the subjects in which Tesla had earned the highest grade in high school.)

At the age of eighty-three, Tesla wrote an autobiographical story for children. It is in letter form, addressed to a twelve-year-old girl, Paula. The title is "The Tom Cat and the Gander". It was probably inspired by Zmaj.

The setting is Tesla's home town Gospić as shown on the photograph sent to him in 1894 by his sister Marica. Tesla describes in a charming way his first encounter with electricity while playing with his wonderful tom cat whom he loved dearly. He then turns to his archfiend, the gander, who was attacking him when ever he showed up because the three-year-old Tesla had once teased him. When his aunts asked him whether he was afraid of an older and stronger village boy, of the cow or the wolf, Tesla's answer was negative. But he had to admit that he feared the gander. Only when the gander with the geese had flown to the nearby river, was the boy happy and could cherish his pigeons.

From all that has been said, one can draw the following conclusion: Tesla was a real genius, i.e. a man of creative imagination and not just an imitative talent. His untiring mind was imbued with numerous ideas at the same time, and he brooded over them until he intuitively found the right solution. Tesla's Weltanschauung was formed by Goethe's humanism, and a romantic adherence to the lofty and sublime paired with a sound portion of Serbian national pride. He strictly refused to fetter his mind with commercial matters and to sacrifice his ideals for material values. In a pragmatically and materialistically oriented society Tesla remained a "loner" and was considered an eccentric.

Tallahassee, Fl.

Nikola R. Pribić

---

\* Lecture given in March 1979 at the University of Toronto

From: ZEITSCHRIFT FÜR VALKANOLOGIE  
Band XVI (1980) pp. 71-81



HOTEL NEW YORKER

(1939)

A Story of Youth Told by Age  
Dedicated To  
Miss Pola Fotitch  
By Its Author  
Nikola Tesla

My dear Miss Fotitch:

I am forwarding to you the "Calendar of Yugoslavia" of 1939 showing the house and community in which I had many joyful and sad experiences and odd adventures and in which also, by a coincidence bizzare, I was born. As you may see from the photograph on the sheet for June, the old-fashiond building is located at the foot of a wooded hill called Bogdanić. Adjoin- ing it is a church and behind it a little further up a graveyard. Our nearest neighbors were two miles away and in the winter, when the snow was six or seven feet deep, our isolation was complete.

My mother was indefatigable and worked regularly from four o'clock in the morning till eleven in the evening. From four to breakfast time, 6 A.M., while others slumbered, I never closed my eyes but wateched my mother with intense pleasure as she attended quickly -- sometimes running -- to her many self-imposed duties. She directed the servants to take care of all domestic animals, milked the cows, performed all sorts of labor unassisted, set the table, prepared breakfast for the whole household and only when it was ready to be served did the rest of the family get up. After breakfast everybody followed my mother's inspiring example. All did their work dil- igitently, liked it and so achieved a measure of contentment. But I was the happiest of them, the fountain of my enjoyment being our magnificent Mačak -- the finest of all cats in the world. I wish that I could give you an adequate idea of the depth of affection which existed between me and him. You would look vainly in the mythological and historical records for such a case. We



simply lived one for the other. Whereever I went Mučak followed primarily owing to our mutual love and then again moved by the desire to protect me. When such a necessity presented itself he would rise to twice his normal height, buckle his back and with the tail as rigid as a metal bar and whisks like steel wires he would give vent to his rage by explosive puffs Pfftt! Pfftt! It was a terrifying sight and whatever provoked him, human being or animal, beat a hasty retreat.

In the evening we went through our usual program. I would run from the house along the church and he would rush after me and grab me by the trousers. He tried hard to make me believe that he would bite, but the instant his needle sharp incisors penetrated the clothing the pressure ceased and their contact with my skin was as gentle and tender as that of a butterfly alighting on a petal. He liked best to roll on the grass with me. While we were doing this he bit and clawed and purred in rapturous pleasure. He fascinated me so completely that I too bit and clawed and purred. We just could not stop and rolled and rolled and rolled and rolled in a delerium of delight. We indulged in this enchanting sport day by day except on rainy weather. In respect to water Mučak was very fastidious. He would jump six feet to avoid wetting his paws. On such occasions we went into the house and, selecting a nice cosy place, abandoned ourselves for each other in affectionate embracement. Mačak was scrupulously clean, had no fleas or bugs whatever, shed no hair and showed none of the objectionable traits and habits of cats as I knew them later. He was touchingly delicate in signifying his wish to be let out at night and scratched the door gently for readmittance.

Now I must tell you of a strange and unforgettable experience which



bore fruit in my later life. Our home is about eighteen hundred feet above sea level and in the winter we had dry weather as a rule, but sometimes it happened that a warm wind from the Adriatic would blow persistently for a long time, melting rapidly the snow, flooding the land and causing great loss of property and life. We would then witness the terrifying spectacle of a mighty seething river carrying wreckage and tearing down everything moveable in its way. Since I often visualized the events of my youth to find relief from great and dangerous mental strain and when I think of the scene the roar of the waters fills my ears and I see as vividly as then, their tumultuous flow and the mad dance of the wreckage. This leaves me, for awhile, sad and depressed. But always agreeable are my recollections of winter with its dry cold and snow of immaculate white.

It happened that on the day of my experience we had a cold drier than ever observed before. People walking in the snow left a luminous trail behind them and a snowball thrown against an obstacle gave a flare of light like a loaf of sugar hit with a knife. It was dusk of the evening and I felt impelled to stroke Mačak's back. What I saw was a miracle which made me speechless from amazement. Mačak's back was a sheet of light and my hand produced a shower of crackling sparks loud enough to be heard all over the place. My father was a very learned man, he had an answer for every question. But this phenomenon was new even to him. Well, he finally remarked, this is nothing but electricity, the same thing you see on the trees in a storm. My mother seemed alarmed. Stop playing with the cat, she said, he might start a fire. I was thinking abstractedly. Is nature a gigantic cat? If so who strokes its back? It can only be God, I concluded. You may know that Pascal was an extraordinarily precocious child who attracted attention



before he reached the age of six years. But here I was, only three years old, and already philosophising!

However stupefying the first observation something still more wonderful was to come. It was getting darker and soon the candles were to be lighted. Mačak took a few steps through the room. He shook his paws as though he were treading on wet ground. I looked at him attentively. Did I see something or was it an illusion?? I strained my eyes and perceived distinctly that his body was surrounded by a halo like the aura of Saints!

I cannot exaggerate the effect of this marvelous sight on my childish imagination. Day after day I asked myself what is electricity and found no answer. Eighty years have gone by since and I still ask the same question, unable to answer it. Some pseudo scientists of whom there are only too many may tell you that he can, but do not believe him. If any of them knew what it is I would also know and the chances are better than any of them for my laboratory and practical experiences is more extensive and my life covers three generations of scientific research.

My childhood in Mačak's delightful company and undying friendship would have passed blissfully if I did not have a powerful enemy, relentless and irreconcilable. This was our gander, a monstrous ugly brute, with a neck of an ostrich, mouth of a crocodile and a pair of cunning eyes radiating intelligence and understanding like the human. I aroused his ire by throwing pebbles at him, a most foolish and reckless act which I bitterly regretted afterwards. I liked to feed our pigeons, chickens and other fowl, take one or the other under my arm and hug and pet it. But the brute would not let me. The moment I entered the poultry yard he would attack me and as I fled grab me by the seat of my trousers and shake me viciously. When I finally



managed to free myself and run away he would flap his huge wings in glee and raise an unholy chatter in which all the geese joined. When I grew up two aunts of mine used to tell me how I answered certain questions they asked. One was aunt Veva who had two protruding teeth like the tusks of an elephant. She loved me passionately and buried them deep in my cheek in kissing me. I cried out from pain but she thought it was from pleasure and dug them in still harder. Nevertheless I preferred her to the other aunt whose name has slipped from my memory and she used to glue her lips to mine and suck and suck and suck until by frantic efforts I managed to free myself gasping for breath. These two aunts amused themselves by asking me all sorts of questions of which I remember a few. Are you afraid of Luka Bogić? No! Luka always carried a gun and threatened to shoot. He robbed other boys of pennies and gave them to me. Are you afraid of the cow? No! That was one of our cows and very nice until one day I slid from a fence on her back for a ride when she made off with me bellowing and threw me. I was none the worse for the experience. Are you afraid of the bad wolf? No! No! This was the wolf I met in the woods near the church. He was looking at me fixedly and approaching slowly. I shouted as usual when a wolf is around and he trotted away slowly. My present visualization of this scene is astonishingly sharp and clear. After a number of such questions one of the aunts asked me; Are you afraid of the gander? Yes! Yes! I replied emphatically, I am afraid of the gander! I had good reason to be. One summer day my mother had given me a rather cold bath and put me out for a sun warming in Adam's attire. When she stepped in the house the gander espied me and charged. The brute knew where it would hurt most and siezed me by the nape almost pulling out the remnant of my umbilical cord. My mother, who came in time to prevent further



injury, said to me: "You must know that you cannot make peace with a gander or a cock whom you have taunted. They will fight you as long as they live." But now and then I would play in the poultry yard to my heart's content for on certain days our geese, led by the gander, rose high in the air and flew down to the meadow and brook where they sported like swans in the water and probably found some food. I would then feed and pet the pigeons, the poultry and our grand resplendant cock who liked me. In the evening the gander brought back his flock who made a few turns above the house and then came down with a deafening noise. The sight of the flying geese was a joy and inspiration to see.

- - -



HOTEL NEW YORKER

A STORY OF YOUTH TOLD BY AGE

DEDICATED TO

MISS POLA FORITCH

BY ITS AUTHOR

NIKOLA TESLA

1939



My dear Miss Potitch:

I am forward to you the "Calendar of Yugoslavia" of 1939 showing the house and community in which I had many joyful and sad experiences and odd adventures and in which also, by a coincidence bizzare, I was born. As you may see from the photograph on the sheet for June, the old-fashioned building is located at the foot of a wooded hill called Bogađanić. Adjoining it is a church and behind it a little further up a graveyard. Our nearest neighbors were two miles away and in the winter, when the snow was six or seven feet deep, our isolation was complete.

My mother was indefatigable and worked regularly from four o'clock in the morning till eleven in the evening. From four to breakfast time, 6 A.M., while others slumbered, I never closed my eyes but watched my mother with intense pleasure as she attended quickly - sometimes running - to her many self-imposed duties. She directed the servants to take care of all domestic animals, milked the cows, performed all sorts of labor unassisted, set the table, prepared breakfast for the whole household and only when it was ready to be served did the rest of the family get up. After breakfast every body followed my mother's inspiring example. All did their work diligently, liked it and so achieved a measure of contentment. But I was the happiest of them, the fountain of my enjoyment being our magnificent Mačak - the finest of all cats in the world. I wish that I could give you an adequate idea of the depth of affection which existed between me and him. You would look vainly in the mythological and historical records for such a case. We simply lived one for the other. Wherever I went Mačak followed primarily owing to our mutual love and then again



moved by the desire to protect me. When such a necessity presented itself he would rise to twice his normal height, buckle his back and with the tail as rigid as a metal bar and whistlers like steel wires he would give vent to his rage by explosive puffs pftt! pftt! It was a terrifying sight and whatever provoked him, human being or animal, beat a hasty retreat.

In the evening we went through our usual program. I would run from the house along the church and he would rush after me and grab me by the trousers. He tried hard to make me believe that he would bite, but the instant his needle sharp incisors penetrated the clothing the pressure ceased and their contact with my skin was as gentle and tender as that of a butterfly alighting on a petal. He liked best to roll on the grass with me. While we were doing this he bit and clawed and purred in rapturous pleasure. He fascinated me so completely that I too bit and clawed and purred. We just could not stop and rolled and rolled and rolled and rolled in a delirium of delight. We indulged in this enchanting sport day by day except on rainy weather. In respect to water Mačak was very fastidious. He would jump six feet to avoid wetting his paws. On such occasions we went into the house and, selecting a nice cosy place, abandoned ourselves for each other in affectionate embracement. Macak was scrupulously clean, had no fleas or bugs whatever, shed no hair and showed none of the objectionable traits and habits of cats as I knew them later. He was touchingly delicate in signifying his wish to be let out at night and scratched the door gently for readmittance.

Now I must tell you of a strange and unforgettable experience which bore fruit in my later life. Our home is about eighteen hundred feet above sea level and in the winter we had dry weather



as a rule, but sometimes it happened that a warm wind from the Adriatic would blow persistently for a long time, melting rapidly the snow, flooding the land and causing great loss of property and life. We would then witness the terrifying spectacle of a mighty seething river carrying wreckage and tearing down everything moveable in its way. Since I often visualize the events of my youth to find relief from great and dangerous mental strain and when I think of the scene the roar of the waters fills my ears and I see as vividly as then, their tumultuous flow and the mad dance of the wreckage. This leaves me, for a while, sad and depressed. But always agreeable are my recollections of winter with its dry cold and snow of immaculate white.

It happened that on the day of my experience we had a cold arrier than ever observed before. People walking in the snow left a luminous trail behind them and a snowball thrown against an obstacle gave a flare of light like a loaf of sugar hit with a knife. It was dusk of the evening and I felt impelled to stroke Macak's back. What I saw was a miracle which made me speechless from amazement. Macak's back was a sheet of light and my hand produced a shower of crackling sparks loud enough to be heard all over the place. My father was a very learned man, he had an answer for every question. But this phenomenon was new even to him. Well, he finally remarked, this is nothing but electricity, the same thing you see on the trees in a storm. My mother seemed alarmed. Stop playing with the cat, she said, he might start a fire. I was thinking abstractedly. Is nature a gigantic cat? If so who strokes it back? It can only be God, I concluded. You may know that Pascal was an extraordinarily precocious child who attracted attention before he reached the age of six years. But here I was,



only three years old, and already philosophizing!

Now ever supplanting the first observation something still more wonderful was to come. It was getting darker and soon the candles were to be lighted. Macak took a few steps through the room. He shook his paws as though he were treading on wet ground. I looked at him attentively. Did I see something or was it an illusion? I strained my eyes and perceived distinctly that his body was surrounded by a halo like the aura of Saints!

I can not exaggerate the effect of this marvellous sight on my childish imagination. Day after day I asked myself what is electricity and found no answer. Eighty years have gone by since and I still ask the same question, unable to answer it. Some pseudo scientists of whom there are only too many may tell you that he can, but do not believe him. If any of them knew what it is I would also know and the chances are better than any of them for my laboratory and practical experiences is more extensive and my life covers three generations of scientific research.

My childhood in Macak's delightful company and undying friendship would have passed blissfully if I did not have a powerful enemy, relentless and irreconcilable. This was our gander, a monstrous ugly brute, with a neck of an ostrich, mouth of a crocodile and a pair of cunning eyes radiating intelligence and understanding like the human. I aroused his ire by throwing pebbles at him, a most foolish and reckless act which I bitterly regretted afterwards. I liked to feed our pigeons, chickens and other fowl, take one or the other under my arm and hug and pet it. But the brute would not let me. The moment I entered the poultry yard he would attack me and as I fled grab me by the seat of my trousers and shake me viciously. When I finally managed to free myself and run away he would flap his huge



wings in glee and raise an unholy chatter in which all the geese joined. When I grew up two aunts of mine used to tell me how I answered certain questions they asked. One was aunt Yeva who had two protruding teeth like the tusks of an elephant. She loved me passionately and buried them deep in my cheek in kissing me. I cried out from pain but she thought it was from pleasure and dug them in still deeper. Nevertheless I preferred her to the other aunt whose name has slipped from my memory and she used to glue her lips to mine and suck and suck and suck until by frantic efforts I managed to free myself gasping for breath. These two aunts amused themselves by asking me all sorts of questions of which I remember a few. Are you afraid of Luka Bogić? No! Luka always carried a gun and threatened to shoot. He robbed other boys of pennies and gave them to me. Are you afraid of the cow? No! That was one of our cows and very nice until one day I slid from a fence on her back for a ride when she made off with me bellowing and threw me. I was none the worse for the experience. Are you afraid of the bad wolf? No! No! This was the wolf I met in the woods near the church. He was looking at me fixedly and approaching slowly. I shouted as usual when a wolf is around and he trotted away slowly. My present visualization of this scene is astonishingly sharp and clear. After a number of such questions one of the aunts asked me; Are you afraid of the gander? Yes! Yes! I replied emphatically, I am afraid of the gander! I had good reason to be. One summer day my mother had given me a rather cold bath and put me out for a sun warming in Adam's attire. When she stepped in the house the gander espied me and charged. The brute knew where it would hurt most and seized me by the nape almost pulling out the remnant of my umbilical cord. My mother, who came



...at time to prevent further injury, said to me: "You must know that you can not make peace with a gander or a cock whom you have taunted.. They will fight you as long as they live." But now and then I would play in the poultry yard to my heart's content for on certain days our geese, led by the gander, rose high in the air and flew down to the meadow and brook where they sported like swans in the water and probably found some food. I would then feed and pet the pigeons, the poultry and our grand resplendant cock who liked me. In the evening the gander brought back his flock who made a few turns above the house and then came down with a deafening noise. The sight of the flying geese was a joy and inspiration to see.

ooo

S-28



NOTE: FOR ANALYSES OF THIS  
PROPOSAL BY CORUM AND MYSELF,  
SEE FOLDER ON FREE-STANDING  
BOOKSHELF OF CORUM PAPERS.



August 23, 1996

Presented herewith is my commentary on the particle-beam weapon proposal. The figures other than Nos. 1 and 2 are not the same as accompanying the proposal as I originally received it. They were obtained later through the Director of the Museum of Science & Technology in Belgrade.

The proposal's appearance in 1984, obtained by Toby Grotz, is as follows: Someone in Arizona (possibly Ralph Bergstresser), who worked for the government and knew Tesla at the end, gave a brittle microfilm (believed to be one of the group copied by U.S. Naval officers at the Manhattan Storage Warehouse where the Tesla estate was held) to Robert Beck, who transcribed it in the form at hand and had a draftsman prepare Figures 1 and 2. It was then given to Andrija Puharich who, in turn, gave it to Toby Grotz.

The proposal is an exercise in units conversion. When Toby was to present it at some conference, he wanted me to clean it up dimensionally. I did this, but asked, "Do you understand the mathematical development?" He replied in the affirmative, so I then said, "If you present this paper, I believe you should be able to explain where the '1000' factor in the denominator of the radical expression on page 14 comes from." He couldn't, and I wasn't about to tell him without an acknowledgement in his paper of my assistance. I have now explained it on page 4 of my commentary.

Not discussed in my commentary is Tesla's recommendation of lava for the gun structure. Lava molded insulators were readily available in the early days of radio, principally manufactured by the American Lava Corporation. The material has a cream color, can withstand temperatures up to 2,000 degrees Fahrenheit, and is an excellent insulator - on the order of porcelain. It has, as I recall, a very low coefficient of linear expansion, somewhere between Pyrex and quartz, and a hardness on the Rockwell scale approaching diamond (don't have a CRC Chemical Engineering Handbook among my references). The reason Tesla chose this material for the gun structure is because of heat resulting from the evacuation process. On page 9 of the proposal, Tesla cites the power for its operation "from 10 to 20 h.p.", equaling 7,500 to 15,000 watts, which must be continuously withstood and dissipated by the gun structure.

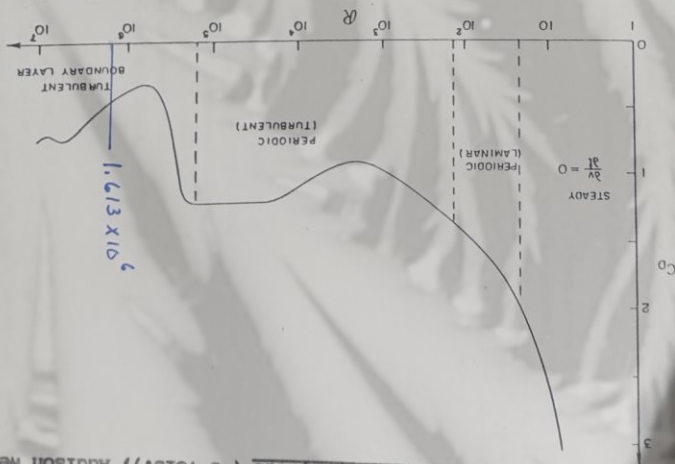


When James Corum and I originally got a copy of the paper, he wrote to me that he was astonished that Tesla chose the diameter of the sphere to produce a velocity of particles corresponding to a Reynolds's Number ( $\mathcal{R}$ )  $1.613 \times 10^5$ , taking advantage of the notch in the well-known drag coefficient curve for spherical objects (Refer to Attachment A, Fig. 41-1 from Feynman's *Lectures on Physics*, Vol. II). This curve was developed in the 1920s by NACA. In later years, studies were performed with high Mach Numbers ( $M$ ). The Tesla particle beam velocity has an  $M$  of 48. Now refer to Attachment B, Fig. 11-13 from Roberson & Crowe's *Engineering Fluid Mechanics*, showing a three-dimensional presentation of  $\mathcal{R}$  vs.  $M$ . The back edge is the curve from Feynman. Notice how the notch quickly disappears by the time  $M = 2$  is reached.

Jim and I went 'round and 'round on this, my assertion was that if Tesla did indeed choose the diameter of the sphere to produce a particle velocity taking advantage of the notch, it was based on a false premise because of the Mach Number consideration. I felt that it was mere coincidence that Tesla chose a sphere of 5 meters. But, maybe not, and if so, it was a mistake. Jim eventually backed away from this idea because ~~it~~ does not appear in his paper referred to at the beginning of my commentary.



Fig. 41-4. The drag coefficient  $C_D$  of a circular cylinder as a function of the Reynolds number.



#### 41-4 Flow past a circular cylinder

Let's go back to the problem of low-speed (nearly incompressible) flow over the cylinder. We will give a qualitative description of the flow of a real fluid. There are many things we might want to know about such a flow—for instance, what is the drag force on the cylinder? The drag force on a cylinder is plotted in Fig. 41-4 as a function of  $R$ —which is proportional to the air speed  $V$  if everything else is held fixed. What is actually plotted is the so-called *drag coefficient*  $C_D$ , which is a dimensionless number equal to the force divided by  $\frac{1}{2}\rho V^2 D$ , where  $D$  is the diameter,  $l$  is the length of the cylinder, and  $\rho$  is the density of the liquid:

$$C_D = \frac{F}{\frac{1}{2}\rho V^2 D l}$$

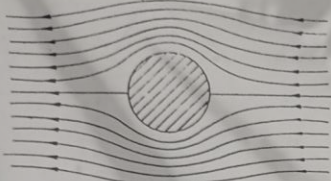
The coefficient of drag varies in a rather complicated way, giving us a pre-hint that something rather interesting and complicated is happening in the flow. We will now describe the nature of flow for the different ranges of the Reynolds number. First, when the Reynolds number is very small, the flow is quite steady; that is, the velocity is constant at any place, and the flow goes around the cylinder. The actual distribution of the flow lines is, however, not like it is in potential flow. They are solutions of a somewhat different equation. When the velocity is very low or, what is equivalent, when the viscosity is very high so the stuff is like honey, then the inertial terms are negligible and the flow is described by the equation

$$\nabla^2 \Omega = 0.$$

This equation was first solved by Stokes. He also solved the same problem for a sphere. If you have a small sphere moving under such conditions of low Reynolds number, the force needed to drag it is equal to  $6\pi\eta aV$ , where  $a$  is the radius of the sphere and  $V$  is its velocity. This is a very useful formula because it tells the speed at which tiny grains of dirt (or other particles which can be approximated as spheres) move through a fluid under a given force—as, for instance, in a centrifuge, or in sedimentation, or diffusion. In the low Reynolds number region—for at less than 1—the lines of  $v$  around a cylinder are as drawn in Fig. 41-5.

If we now increase the fluid speed to get a Reynolds number somewhat greater than 1, we find that the flow is different. There is a circulation behind the sphere, as shown in Fig. 41-6(b). It is still an open question as to whether there is always

Fig. 41-5. Viscous flow (low velocities) around a circular cylinder.



Attachment A



by John A. Robertson and Clayton T. Crowe, Houghton Mifflin, 1969

the free-stream flow at which sonic flow first appears on the body is called the *critical Mach number*. Further increases in flow velocity result in shock-wave formation and an appreciable increase in wave drag, due to notes in Fig. 11-12 that the drag coefficient begins to rise sharply at about this Mach number. The critical Mach number for the pointed body is larger and correspondingly, the rise in drag coefficient occurs at a Mach number closer to unity.

The drag-coefficient data for the sphere shown in Fig. 11-12 are for a Reynolds number of the order of  $10^4$ . The sphere-drag data shown in Fig.

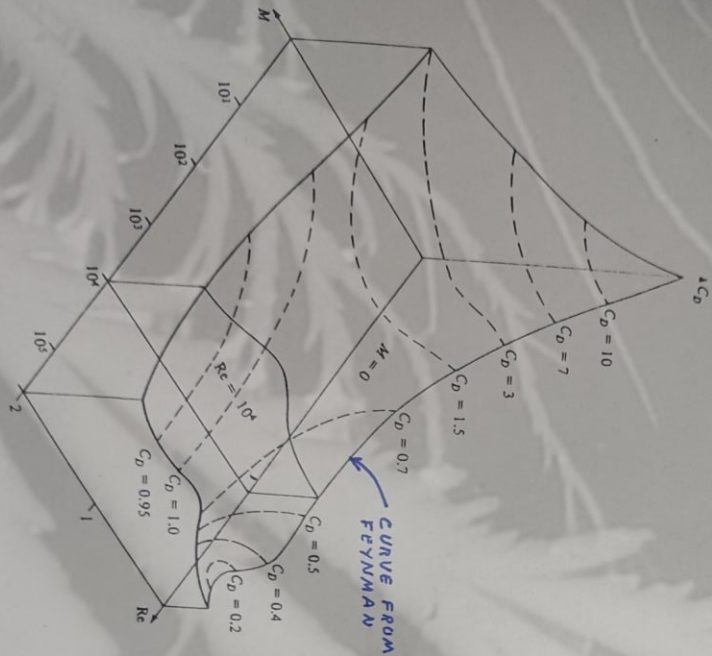


FIGURE 11-13 Contour plot of the drag coefficient of the sphere versus Reynolds and Mach numbers. [After Crowe (6).]

11-11, on the other hand, are for very low Mach numbers. The question then arises about the general variation of the drag coefficient of a sphere with both Mach number and Reynolds number. Information of this nature is often needed to predict the trajectory of a body through the upper atmosphere and sometimes to analyze the flows transporting solid-phase particles.

A contour plot of the drag coefficient of a sphere versus both Reynolds and Mach numbers based on available data (5) is shown in Fig. 11-13. One notices the  $C_D$ -versus- $Re$  curve from Fig. 11-11 in the  $M = 0$  plane. Correspondingly we see the  $C_D$ -versus- $M$  curve from Fig. 11-12 in the  $Re = 10^4$  plane. We see, then, that at low Reynolds number,  $C_D$  decreases with increasing Mach number, whereas at high Reynolds number the opposite trend is observed. Using this figure the engineer can determine the drag coefficient of a sphere at any  $Re$ - $M$  combination. Of course, corresponding  $C_D$  contour plots can be generated for any body, provided the data are available.

## 11-8 LIFT

In Sec. 11-1 it was shown that a differential pressure between the top and bottom of a body will cause a lateral force or lift to be imposed on the body. However, no explanation was given for the cause of the differences in velocity which produces such a pressure distribution. In this section, we will consider circulation—which is the basic cause of lift; then we will consider the lift and drag characteristics of typical airfoils.

### Circulation

Consider flow along a closed path such as is shown in Fig. 11-14. Along any differential segment of the path the velocity can be resolved into components that are tangent and normal to the path. Let us signify the tangential component of velocity as  $V_t$ . Now, if we integrate  $V_t dL$  around the curve, the resulting quantity is called circulation, which is identified by the Greek symbol  $\Gamma$  (capital gamma). Hence, we have

$$\Gamma = \oint V_t dL \quad (11-10)$$

In applying Eq. (11-10), sign convention dictates that tangential velocity vectors that have a counterclockwise sense around the curve are taken as negative, and velocity vectors that have a clockwise direction have a positive contribution.<sup>1</sup> The circulation for an irrotational vortex is determined

<sup>1</sup> The sign convention is opposite that for the mathematical definition of a line integral.

Attachment B



Reader's Aid  
for  
TESLA'S TELEFORCE PROPOSAL

The Tesla particle-beam weapon proposal is at initial reading difficult because of the treatment of the subject in electrostatic units (esu) which are not in common use today. Relationships are also introduced which may not be familiar or obvious. In addition there are frequent omissions of denominators in ratio expressions. The first example is found on page 3, line 18: the field intensity should be  $3 \times 10^7$  volts/cm.

A few typographical errors occur in the proposal and these shall be addressed in the context of discussion for those pages. Some helpful conversions in reading the proposal:

$Q$  = electrostatic charge expressed in electrostatic units (esu) or in coulombs (coul), and  
 $1 \text{ coulomb} = 3 \times 10^9$  electrostatic units.  
 $1 \text{ esu (field intensity)} = 300 \text{ volts/cm.}$   
 $1 \text{ dyne} = 1.020 \times 10^{-3} \text{ gm; } 1 \text{ joule} = 10^7 \text{ dyne-cm}$   
 $= 1.020 \times 10^4 \text{ gm-cm.}$

Capacity of an isolated sphere:

$C = 4\pi k_0 R$  where  $k_0$  = permittivity of free space

$$= \frac{1}{36\pi \times 10^9} \text{ and}$$

$R$  = radius of sphere in meters.

$$\therefore C = \frac{4\pi R}{36\pi \times 10^9} = R \times 10^{-9} \text{ farad, or } R \times 10^3 \text{ picofarad.}$$



With radius  $r$  of sphere expressed in centimeters,

$$C = \frac{r \times 10^{-11}}{9} \text{ farad, or } \frac{10r}{9} \text{ picofarad.}$$

---

Potential of isolated charged sphere:

From general relationships,  $V = \frac{Q}{C}$  where  $V$  is potential in volts,  
 $Q$  = charge in coulombs, and  
 $C$  = capacity in farads.

Expressed in electrostatic units, the potential of an isolated

$$\text{charged sphere} = \frac{Q_{\text{esu}} \times \frac{10^{-9}}{3}}{r_{\text{cm}} \times \frac{10^{-11}}{9}} = 300 \frac{Q_{\text{esu}}}{r_{\text{cm}}} \text{ volts} \quad [\text{Eq. 1}].$$

---

On page 3 some useful relationships appear. Lines 16-17 show a factor of  $100 \times R_{\text{esu/cm}}$  as the maximum potential of a sphere before corona takes place, where  $R$  is in centimeters. This is derived from the fact that the limiting electrostatic field before corona takes place ( $\delta$ ) is approximately  $3 \times 10^6$  volts/meter, or a charge density of  $2.65 \times 10^{-5}$  coulombs/meter<sup>2</sup>. Thus,

$$\begin{aligned} \delta_{\text{max}} &= 2.65 \times 10^{-5} \text{ coulombs/meter}^2 \times 3 \times 10^9 \text{ esu/coulombs} \\ &= 7.95 \times 10^4 \text{ esu/meter}^2 = 7.95 \text{ esu/centimeter}^2 \text{ or essentially} \\ &8 \text{ esu/centimeter}^2 \text{ as given in line 21.} \end{aligned}$$

Assume a sphere of radius  $r$  centimeters. The surface area is  $4\pi r^2 = 12.56 r^2$ . Charging the sphere to  $\delta_{\text{max}}$ , or  $8 \text{ esu/cm}^2$ , the total maximum charge ( $Q_{\text{max}}$ ) will be  $8 \text{ esu/cm}^2 \times 12.56 r^2 \text{ esu/cm}^2 = 100.5 r^2 \text{ esu/cm}^2$ , or essentially  $Q_{\text{max}} = 100 r^2 \text{ esu/cm}^2$ .



Since, in general relationships,  $Q = C \times V$  and with  $C = r$ ,  
 $V_{\max} = \frac{Q_{\max}}{r}$ . Therefore, the maximum potential of a sphere before  
corona takes place is, from Eq. 1,

$$V_{\max} = 300 \frac{Q}{r} = 300 \frac{100 r^2}{r} = 30,000 r \text{ volts.}$$

In this proposal (pp. 13-14), Tesla gives an example of a  
sphere of radius  $R = 250$  cm. Therefore, the maximum potential be-  
fore corona takes place is  $V_{\max} = 3 \times 10^4 \times 250 = 7.5 \times 10^6$  volts  
(p. 14, line 2). For his Wardencliff tower cupola having a diam-  
eter of 20 meters, since  $V_{\max}$  is proportional to the radius,  
 $V_{\max} = 7.5 \times 10^6 \frac{1,000}{250} = 30 \times 10^6$  volts.

In his article "Possibilities of Electrostatic Generators,"  
*Scientific American*, March 1934 p. 133, Tesla planned to charge  
the tower cupola to  $30 \times 10^6$  volts.

It is to be noted from Part IV of Tesla's "My Inventions,"  
*Electrical Experimenter*, May 1919, p. 17 [refer to Attachment A],  
Tesla gives an expression for disruptive potential of a sphere,  
 $V_d = 75,400 r$  volts, which is  $2^{1/2}$  times the potential of a sphere  
before corona takes place -- his useful rule-of-thumb estimate.

On page 6, Tesla employs a form of Torricelli's relation to  
calculate the velocity of an air jet (streamline flow assumed).  
Note that the units at the bottom of the page should be as fol-  
lows:

$$g = 9.91 \text{ meters/sec}^2$$

$$p = 10,332.9 \text{ kilograms/m}^2$$

$$w = 1.2929 \text{ kilograms/m}^3 = 0.00012929 \text{ gm/cm}^3.$$

These values give

$$v = 396 \text{ meters/sec.}$$



The discussion proceeds quite nicely to pages 9-10 and 14. The change that occurred which made possible the gain in charging of particles to 100,000 times a greater value (p. 10), aside from the gain due to the increase in potential of the sphere by the technique illustrated by Figures 3 and 4, is the "electrical connection" of the particle to the large sphere (p. 9, lines 9 and 10). This "connection" is, of course, that of the charged particle stream itself and is the natural consequence of providing such a stream.

On pages 10 and 14, a "best effect" distance  $D = 2R$  is described, where  $D$  = distance at which a particle leaves the vacuum space and  $R$  = radius of the spherical terminal. A discussion at the top of page 10 refers to results "previously obtainable," namely as described on page 4. The best-effect distance is, therefore, the greatest difference in potential ( $V$ ) per length of gun (i.e.,  $D - d$ ). Noting that the repulsive force on a particle is initially zero, reaching a maximum at some near distance from the sphere, this distance can be found by taking the differential  $\frac{\partial V}{\partial D}$  of  $\frac{Q}{D} - \frac{Q}{d}$  and setting equal to zero, obtaining  $D = 2R$  for the best-effect distance.

A typographical error occurs on page 14, line 6, giving the best-effect distance expression. Instead of  $d = 2R$ , it should read  $D = 2R$  conforming to the aspects of Fig. 5. Thus, for the gun described,  $D = 2R = 500$  centimeters and the tip of the gun will extend approximately 250 centimeters from the surface of the sphere.

On page 13, an expression is introduced for the velocity of a charged particle accelerated in an electric field. The force ( $F$ ) acting on a charged particle ( $q$ ) in an electric field ( $\mathcal{E}$ ) is  $F = \mathcal{E}q$ . Newton's second law of motion expresses that the acceler-



ation (a) on a particle having a mass (m) acted on by a force (F) is  $F = ma$ . Thus,  $\mathcal{E}q = ma$ . The work done by the field accelerating the charged particle is  $\mathcal{E}qD = 1/2mV^2$ , where V is the velocity attained by a particle accelerated through the distance D. Therefore,  $V^2 = \frac{2\mathcal{E}qD}{m}$  or  $V = \sqrt{\frac{2\mathcal{E}qD}{m}}$ .

Coulombs law of force between charges is  $F = \frac{Qq}{D^2}$ , and therefore substitutnig,  $V = \sqrt{2\frac{Qq}{D^2} \cdot \frac{D}{m}} = \sqrt{\frac{2Qq}{mD}}$ , the expression at the bottom of page 13 with exception that the "d" in the dominator of the radical should be "D" to conform to aspects of Fig. 5.

Tesla examines the particle acceleration path as two components,  $V_1$  and  $V_2$ .  $V_1 = \sqrt{2Qq(D-d)/mD}$ , and since d is approximately one-half D, this reduces to  $V_1 = \sqrt{2Qq/md}$ .

To examine the reasonableness of the approximation, for example let  $d = 260$  centimeters, allowing 10 centimeters for the particle projection nozzle,  $\frac{D-d}{dD} = \frac{500 - 260}{260 \times 500} = \frac{240}{260 \times 500} = \frac{0.92}{500}$ . With  $\sqrt{0.92} = 0.96$ , only 4 percent less velocity results for particles inside the extension tube (labeled "5" in Figs. 2 and 5).

For  $V_2 = \sqrt{2Qq'/mD}$ , "D" is not the same as D in  $V_1$  but a "very great distance." As such, the  $V_2$  term becomes negligible, and the equation at the bottom of page 13 results with the exception, as noted above, that the "d" in the denominator of the radical should be "D."

Some typographical errors on page 14 result in expression faults. As noted above, the "d" on line 6 should be "D." Errors in exponents at the bottom of the page arise from an incorrect joules-cgs conversion factor of  $10^5$  instead of  $10^4$  as given on page 1 of this Aid. Therefore,



in line 19, " $10^6$  gram-centimeters<sup>2</sup>/sec<sup>2</sup>)" should be

" $10^5$  gram-centimeters<sup>2</sup>/sec<sup>2</sup>,"

in line 20, " $mV^2/2 = 10^6$  (gram-centimeters<sup>2</sup>/sec<sup>2</sup>)" should be

" $mV^2/2 = 10^5$  gram-centimeters<sup>2</sup>/sec<sup>2</sup>," and

in line 21, " $V^2 = 2 \times 10^6 \times 10^{11}/7696$  (cm<sup>2</sup>/sec<sup>2</sup>)" should be

" $V^2 = 2 \times 10^5 \times 10^{11}/7686$  cm<sup>2</sup>/sec<sup>2</sup>."

It should be noted, however, that the resultant particle velocity calculation is correct, as given below, indicating the typographical errors were made in preparation of the typewritten document. For units expressed completely,

in line 22, " $V = 1,613,000$  centimeters or 16,130 meters" should be

" $V = 1,613,000$  centimeters/sec or 16,130 meters/sec," or Mach 48.

It may be informative to show the explicit numerical evaluation of the equation at the bottom of page 13 (noting that the denominator of the radical expression should be "mD") as presented on page 14, line 14:

$$V = \sqrt{\frac{2 \times 5 \times 10^7 \times 1000 \times 10^{11}}{7685 \times 500 \times 1000}}$$

$\frac{Q \text{ in}}{\text{esu}}$	$\frac{q \text{ in}}{\text{esu}}$	$\frac{\text{tungsten}}{\text{particle}}$	$\frac{D}{2R}$	$\frac{\text{dynes-}}{\text{to-gm}}$
$\frac{\text{dynes}}{\text{dynes}}$		$\frac{\text{wt. in gm}}{\text{wt. in gm}}$	$\frac{\text{cm}}{\text{cm}}$	$\frac{\text{conversion.}}{\text{conversion.}}$



DR. NICOLA TESLA, NOTED INVENTOR, (ABOVE) WHOSE  
ACHIEVEMENTS IN HIGH FREQUENCY TRANSMISSION, WIRELESS  
AND OTHER FIELDS HAVE WON HIM INTERNATIONAL FAME,  
BIRTH, DEATH, AND BURIAL

## ACME NEWSPICTURES

DIVISION OF NEA SERVICE, INC.

EXECUTIVE OFFICES: 461 EIGHTH AVE. • • • TELEPHONE BRYANT 9-6914  
NEW YORK CITY 1, NEW YORK

November 16, 1951

Mr. Leland I. Anderson  
127 Seymour Ave. S. E.  
Minneapolis, Minn.

Dear Mr. Anderson:

We have five photos of Dr. Nikola Tesla.  
These are available for scrap book use  
only in 8x10 glossy finish at \$2.00 each,  
plus 12 cents postage.

Should you be interested in obtaining  
prints, just send us your check or money  
order in the proper amount and we shall  
be happy to send the prints.

Sincerely,

*Alice White*

Alice White  
Special Service Dept.

aw



951

will cease to exist. For well the spectacle  
of the Great Lakes more

WESTMAN-SAFETY-KODAK



Alice White Alice Dept.



OFFICES: 461 EIGHTH AVE.

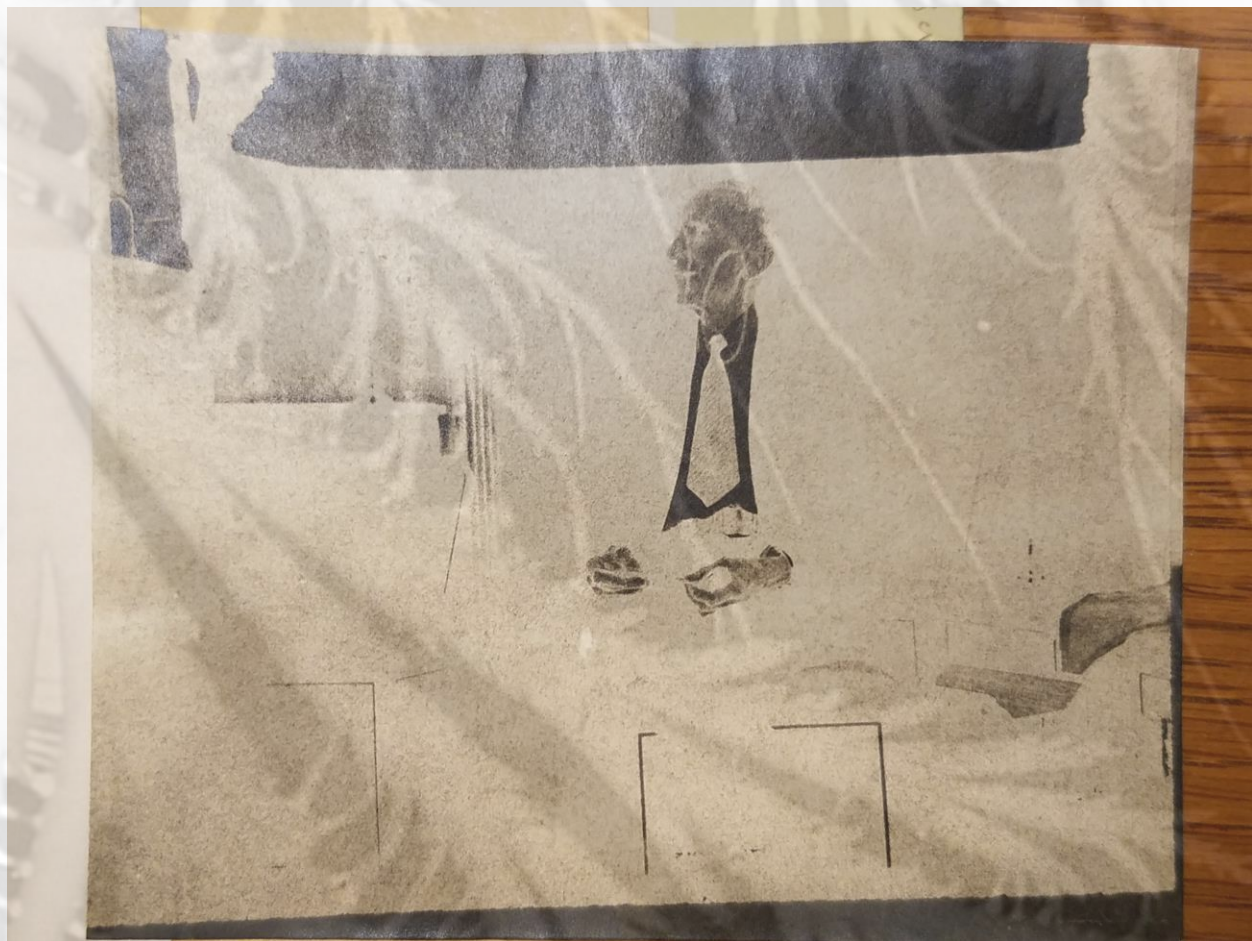
• • • TELEPHONE BRYANT 9-6914















NIKOLA TESLA

calculations to prove that in a few more  
all the overflow of the Great Lakes will  
going through the turbines and the "spectacle  
will cease to exist. Very well! We can do



N 270940

LONG-DISTANCE DEATH HIS SECRET

DR. NIKOLA TESLA, NOTED INVENTOR, (ABOVE) WHOSE ACHIEVEMENTS IN HIGH FREQUENCY TRANSMISSION, WIRELESS AND OTHER FIELDS HAVE WON HIM INTERNATIONAL FAME, ANNOUNCED HIS SEVENTY-EIGHTH BIRTHDAY, JULY 11TH, THAT HE HAD PERFECTED A DEATH-DEALING BEAM, CAPABLE OF DESTROYING A FLEET OF PLANES FROM A DISTANCE OF 200 MILES. HE HOPES TO BE ABLE TO PRESENT HIS LETHAL DISCOVERY BEFORE THE DISARMAMENT CONFERENCE AT GENEVA.

CREDIT LINE (ACME)

6/12/34

312103

DR. TESLA REVEALS "FIND" ON BIRTHDAY

DR. NIKOLA TESLA, PICTURED IN NEW YORK, JULY 10, ON THE OCCASION OF HIS 79TH BIRTHDAY, WHEN HE MADE PUBLIC HIS LATEST DISCOVERY. THE NOTED SCIENTIST CLAIMED PERFECTION OF A PROCESS FOR PRODUCING DIRECT ELECTRICAL CURRENT BY INDUCTION, THIS ELIMINATING THE HERETOFORE INDISPENSABLE COMMUTATOR. HE SAID THAT ULTIMATELY HIS PROCESS WOULD BECOME AS NECESSARY TO EVERY DAY LIFE AS THE ELECTRIC LIGHT.

CREDIT LINT (ACME)

7/10/35

589520

INVENTOR FETES FIGHTING ZIVICS

NEW YORK: - DOCTOR NIKOLA TESLA, FAMED INVENTOR, AGAIN CAME OUT OF SECLUSION WHEN HE GAVE THE FIGHTING ZIVIC BROTHERS, OF PITTSBURGH, LUNCHEON IN HIS SUITE IN THE HOTEL NEW YORKER, JANUARY 17. LEFT TO RIGHT: JOE ZIVIC, FRITZIE ZIVIC, WHO MEETS HENRY ARMSTRONG IN DEFENSE OF HIS WELTER-WEIGHT TITLE LATER IN THE DAY; DR. NIKOLA TESLA, JACK, PETE AND EDDIE ZIVIC.

CREDIT LINE (ACME)

1/17/41

(WS)





New York 1, N. Y.



May 23, 1958

United Press Newspictures  
461 Eighth Avenue  
New York 1, N. Y.

Gentlemen:

This week I received an 8 x 10 glossy print of Nikola Tesla (# 312103) which showed only the portion enclosed in red on the attached illustration. If you can furnish all of the photo shown in the attached illustration, please forward. Remittance will be sent promptly by return mail.

Sincerely,

Folger



WIDE WORLD PHOTOS, INC.

50 ROCKEFELLER PLAZA N. Y., 10020 (212) 262-6300

March 28 1980

Mr. Leland Anderson  
2525 South Meade Street  
Denver, Colorado 80219

Dear Mr. Anderson:

We have researched our files, but regretfully are unable to  
locate the photo you asked about in your letter 2/21/80.

I hope you will call on us when we might be helpful in the  
future.

Sincerely,

*Jack Smor*

PAUL M. CLIFFORD  
GENERAL SALES MANAGER

check of  
e failed  
They

50 N. Y., 10020 (212)

WIDE WORLD



PHOTOS,

MEYER GOLDBERG  
GENERAL SALES MANAGER



WIDE WORLD



PHOTOS, INC.

50 ROCKEFELLER PLAZA N. Y., 10020 (212) PLAZA 7-1111

July 31, 1968.

Mr. Leland I. Anderson  
Five Circle East  
Minneapolis, MINNESOTA 55436

Dear Mr. Anderson:

We regret to inform you that after a thorough check of both The Associated Press and Wide World files, we failed to locate the negatives of the photos requested. They belong to American Press Association.

Thank you for writing Wide World.

Sincerely,

*Meyer Goldberg*  
Meyer Goldberg

el

MEYER GOLDBERG  
GENERAL SALES MANAGER

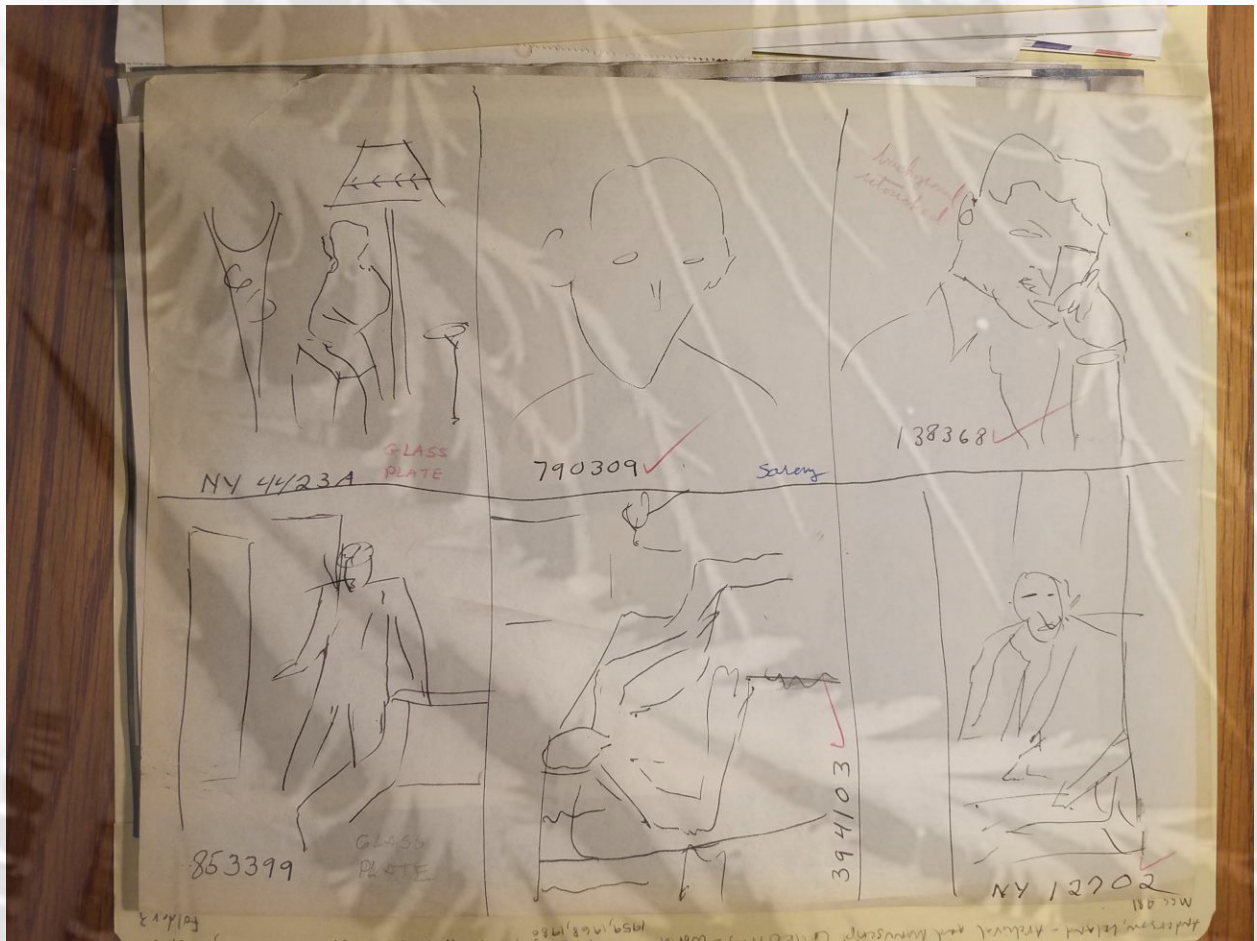


WIDE WORLD PHOTOS, INC.

✓ 874153 - purchased 7-10-35  
GLASS PLATE NY 4423B - purchased 1934  
GLASS PLATE NY 4423A - Nikola Tesla, Inventor 1934  
138368 - Nikola Tesla, Inventor 1934  
790309 - Nikola Tesla -33  
853399 - Nikola Tesla 7-10-36  
✓ 394103 - Nikola Tesla, 77 year old in July 11, 1933  
Made at Hotel General Clinton, N.Y.C.  
NOTED INVENTOR TO CELEBRATE BIRTHDAY  
✓ NY 12702 - New York, Nikola Tesla, father of radio and of  
modern power transmission who will celebrate his  
birthday on July 10th, as he appeared today in  
his suite at the Hotel New Yorker.

7/8/35

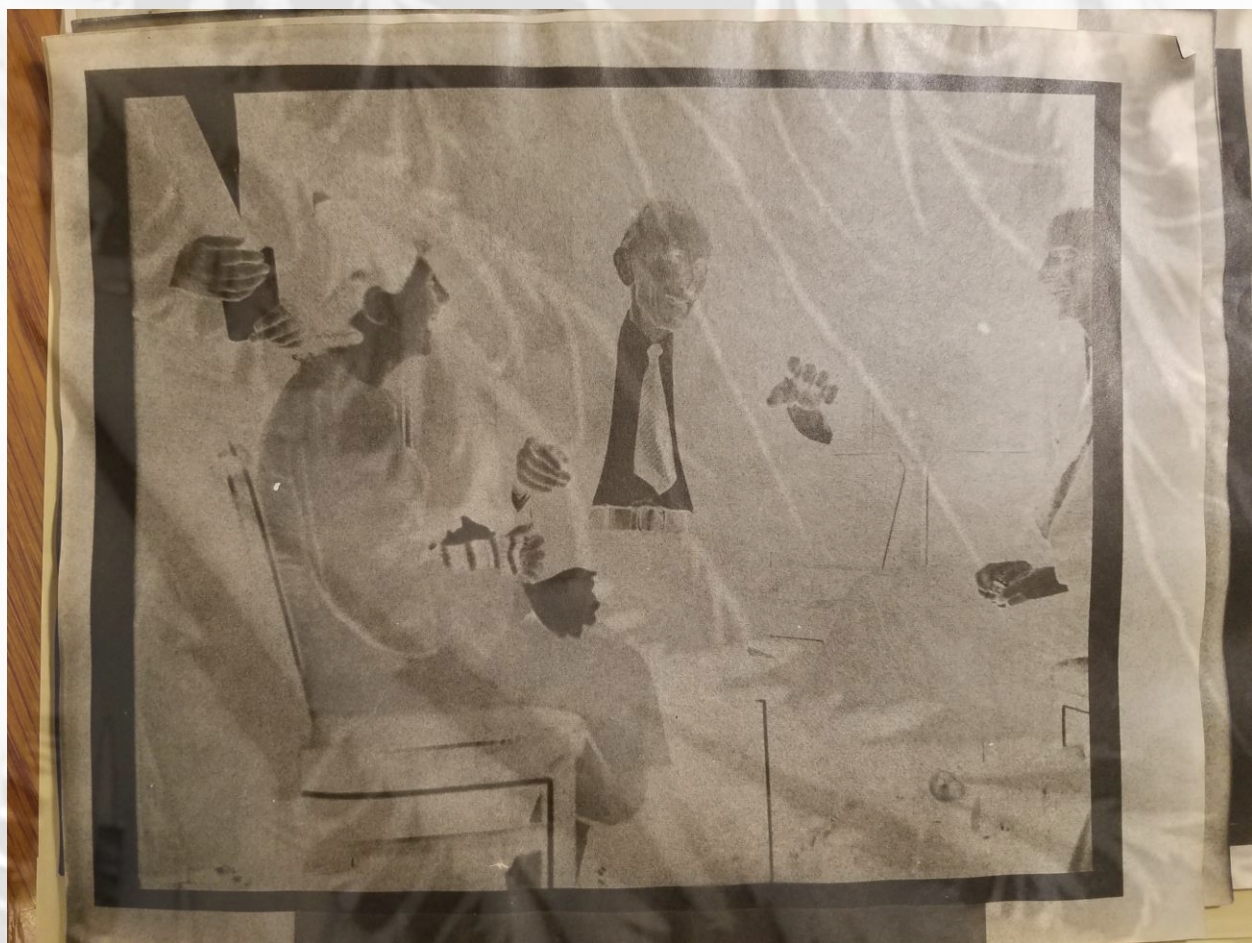


















HOTEL NEW YORKER



Folder 3



HOTEL NEW YORKER



Folder 3



HOTEL NEW YORKER





HOTEL NEW YORKER







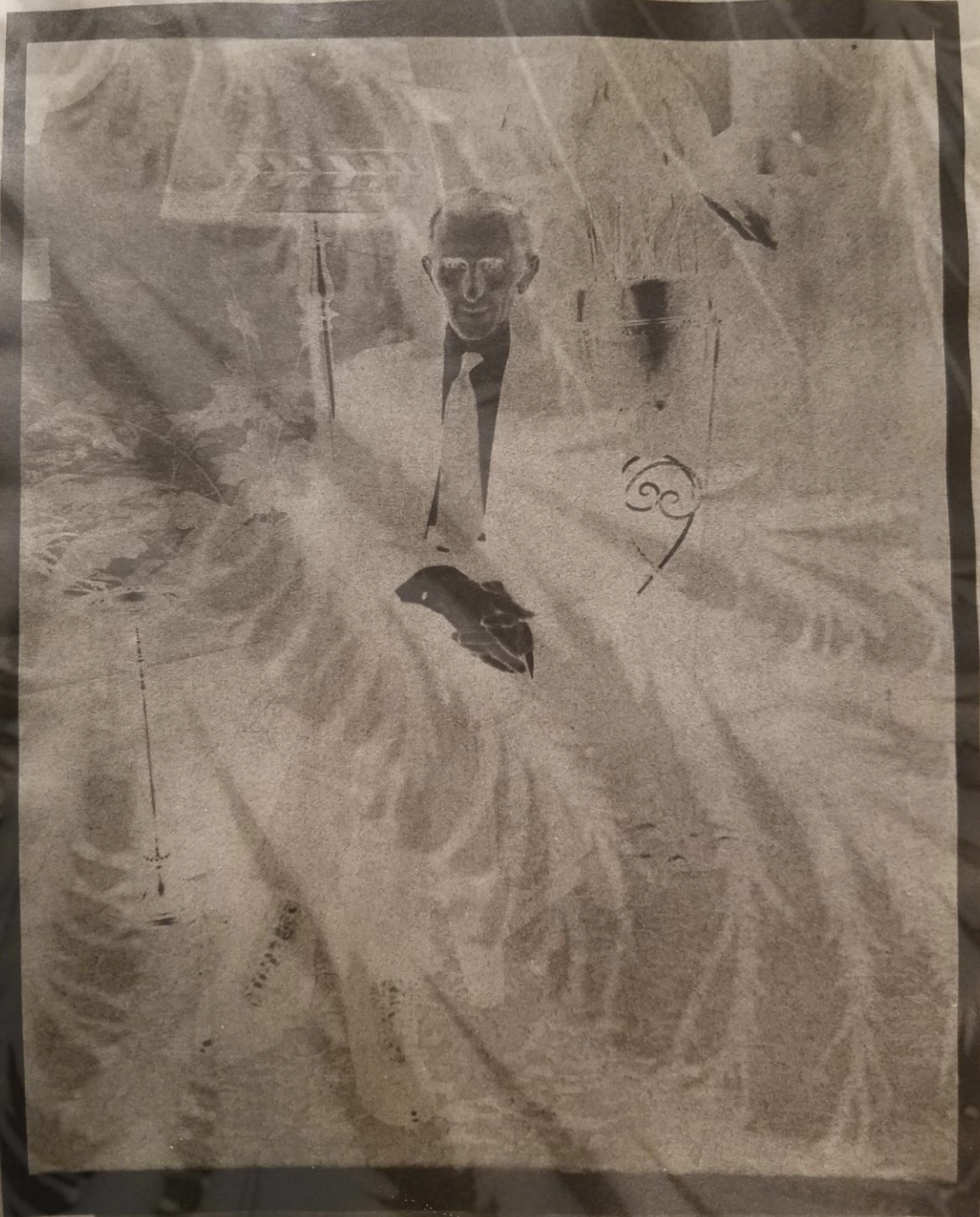


HOTEL NEW YORK





HOTEL NEW YORKER



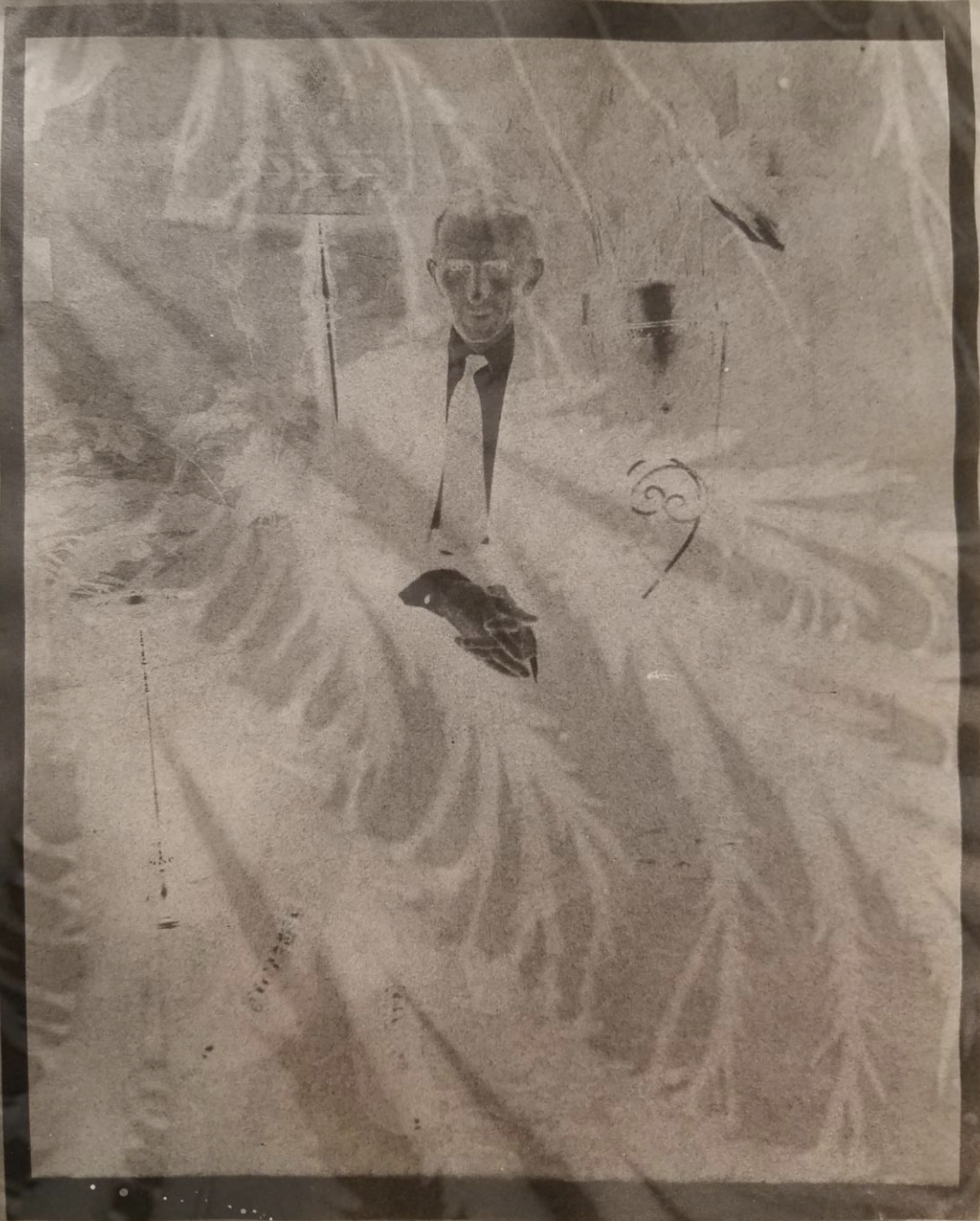


FORM W-111-100-1

WIDE WORLD PHOTOS, INC.

1000 Broadway, New York 18, N. Y.  
Phone 1-1111

1-1111





HOTEL NEW YORKER













HOTEL NEW YORKER





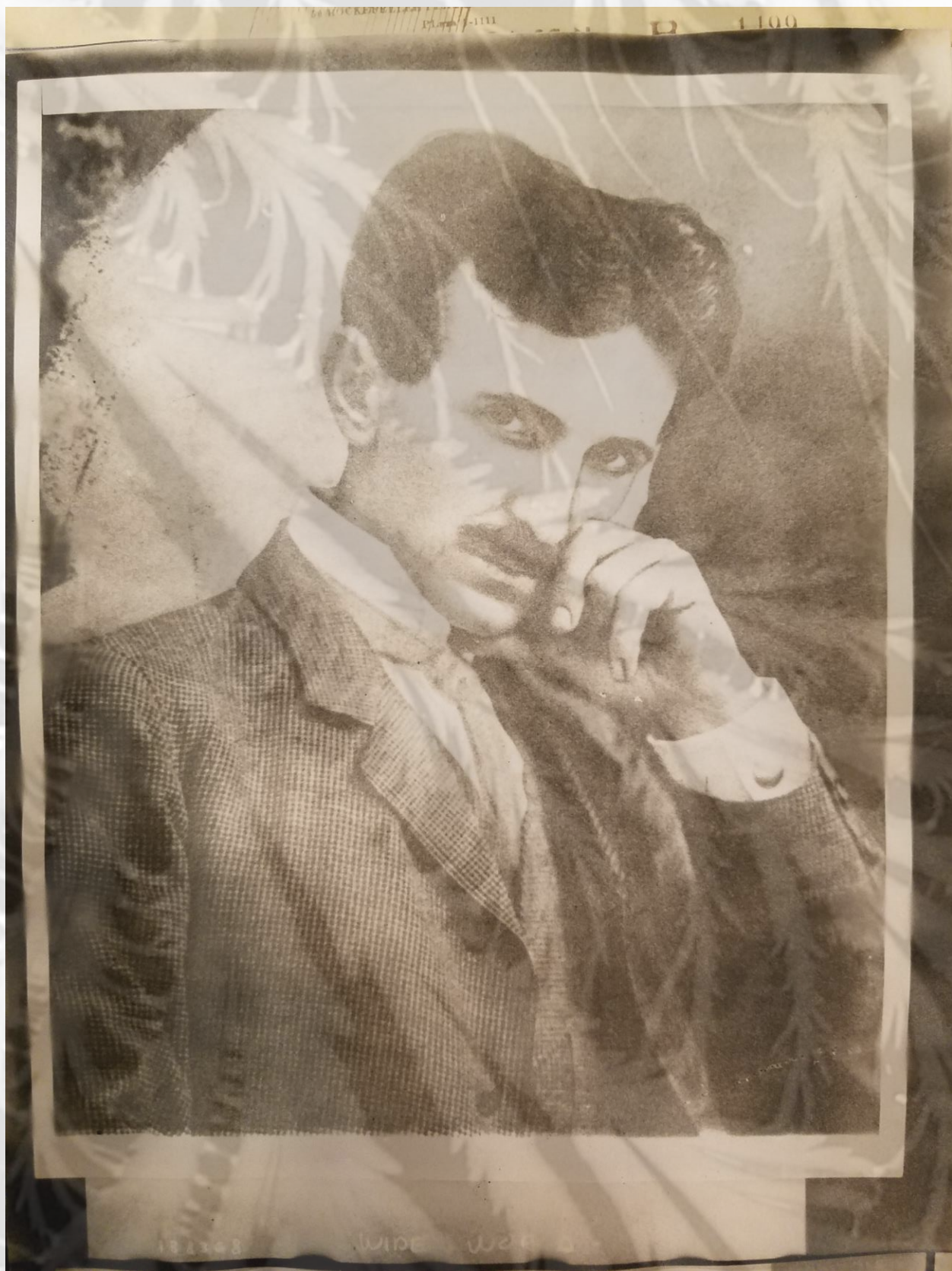




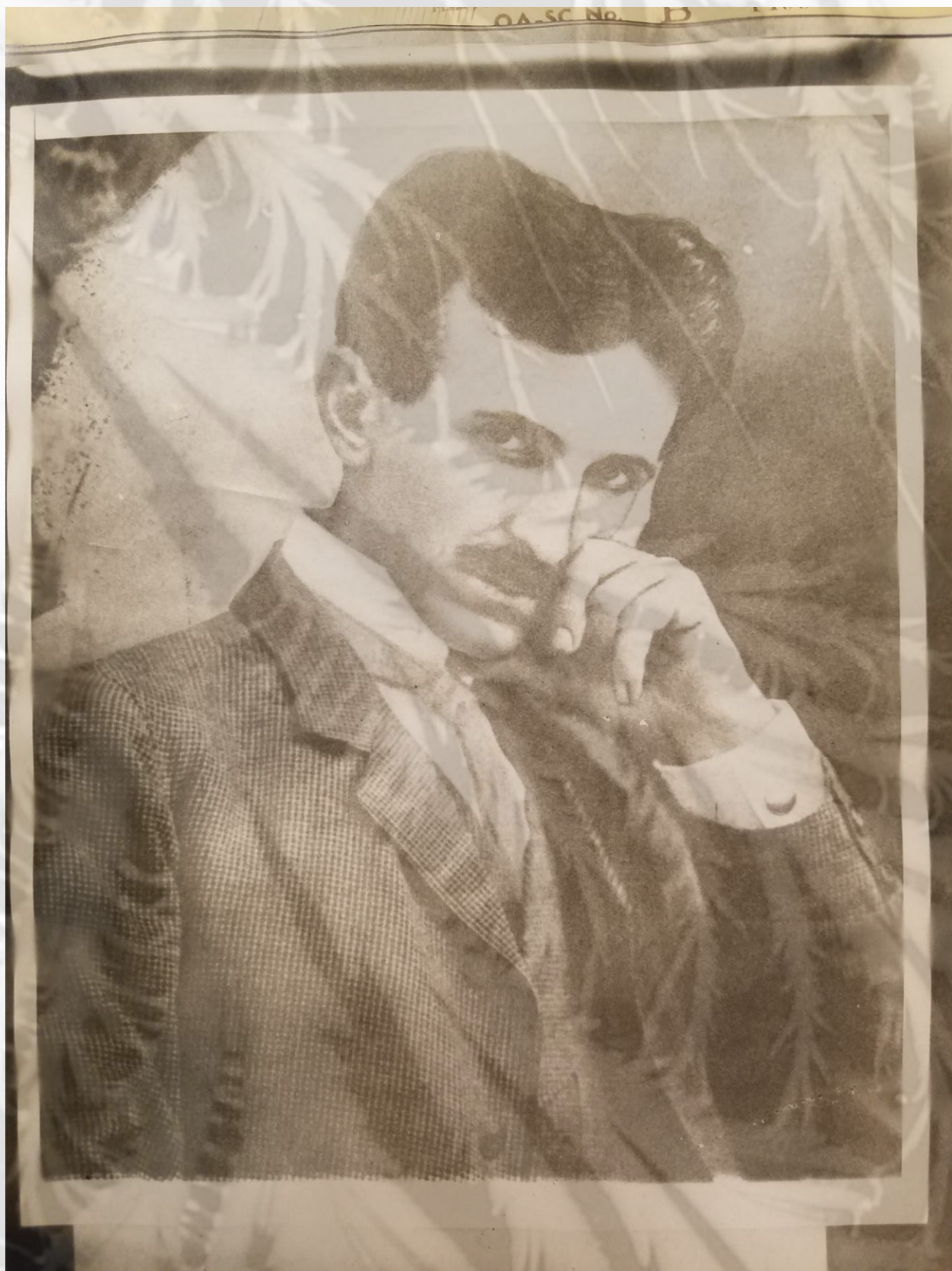
HOTEL NEW YORKER







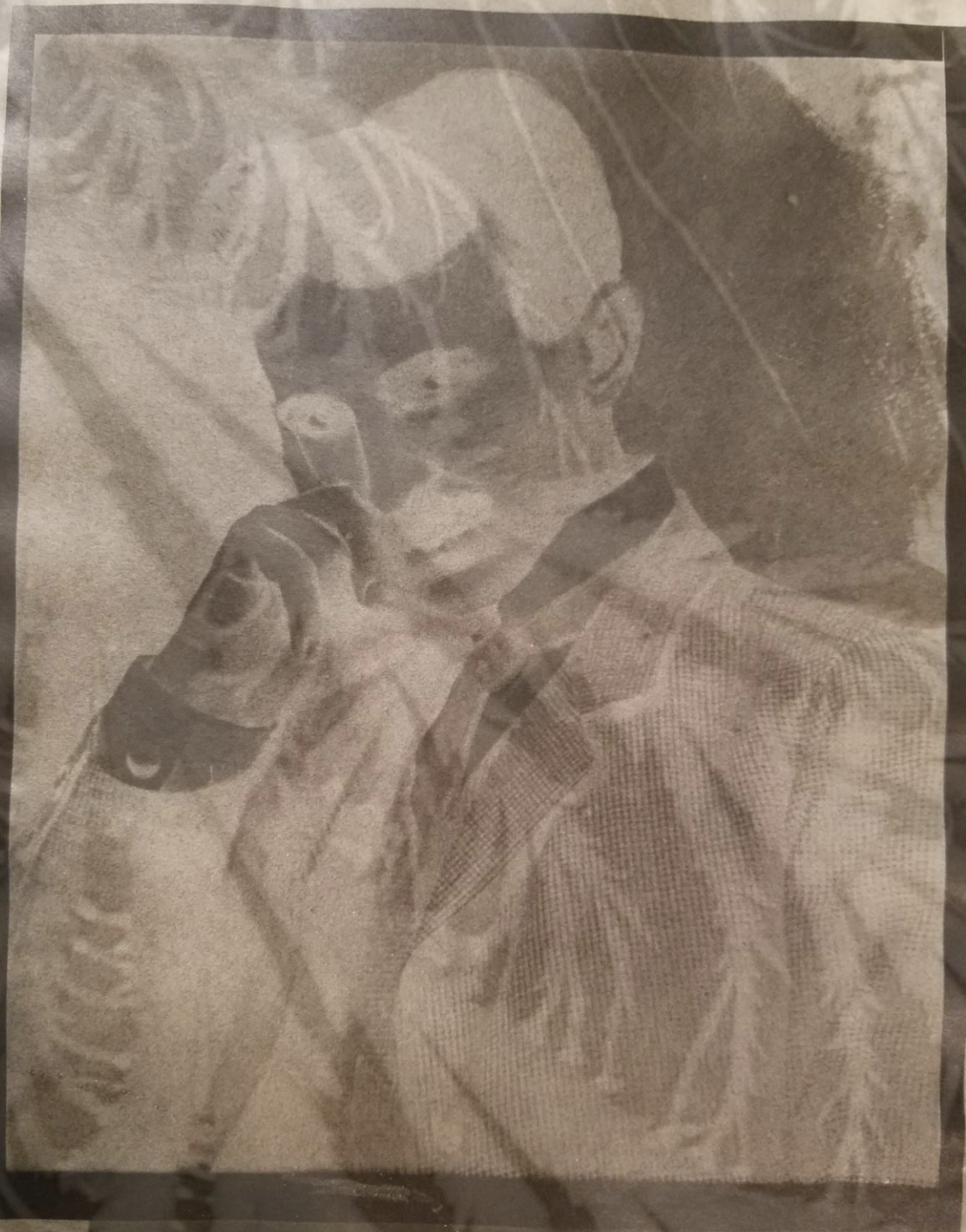






1111

QA-SC No. B 1499





FORM W-10 (1-1-59)

WIDE WORLD PHOTOS, INC.

NEW YORK 19, N. Y.

PA. 1111

QA-SC No.

B

1499





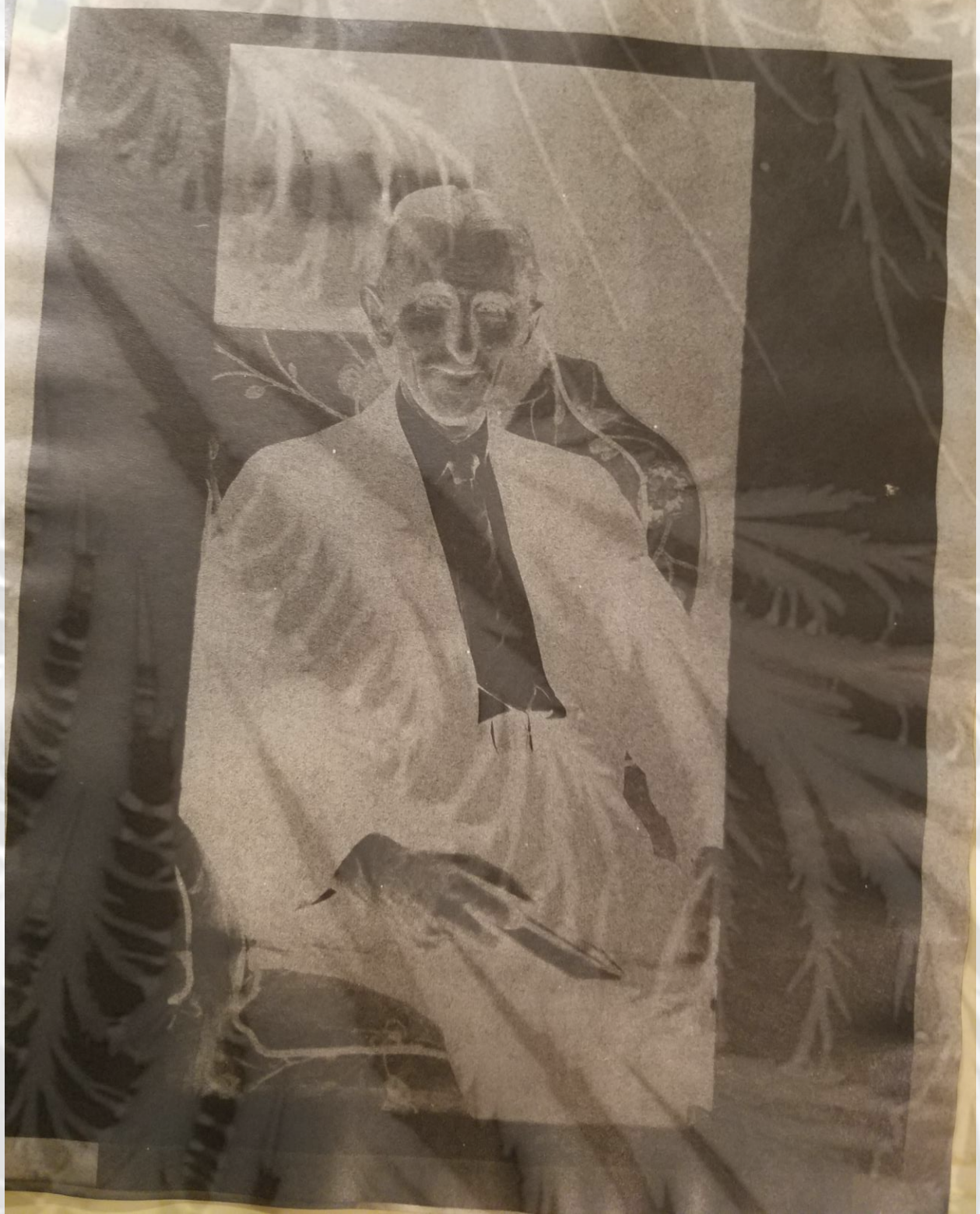
NEW YORK

1911

SA SC No

B

1499

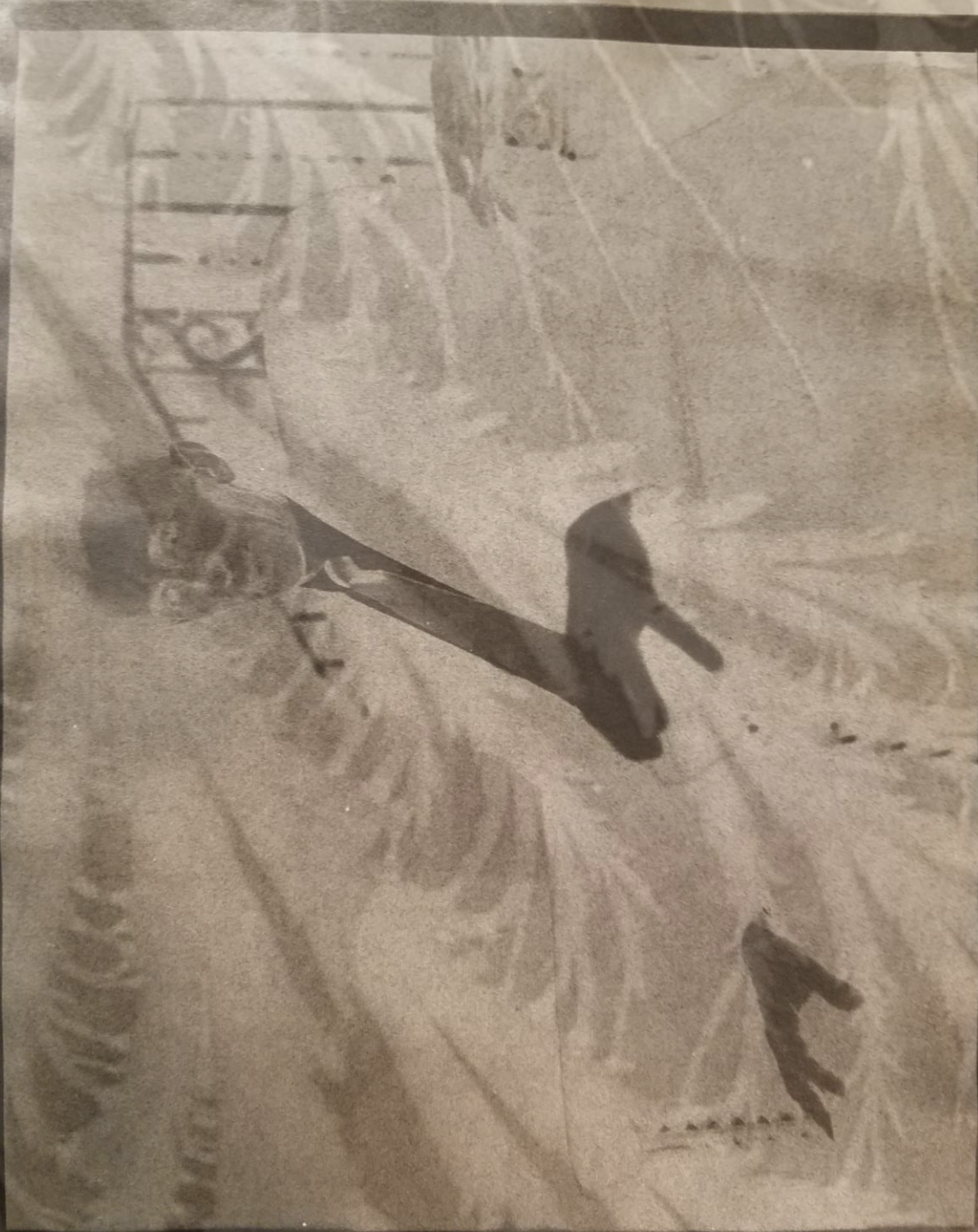




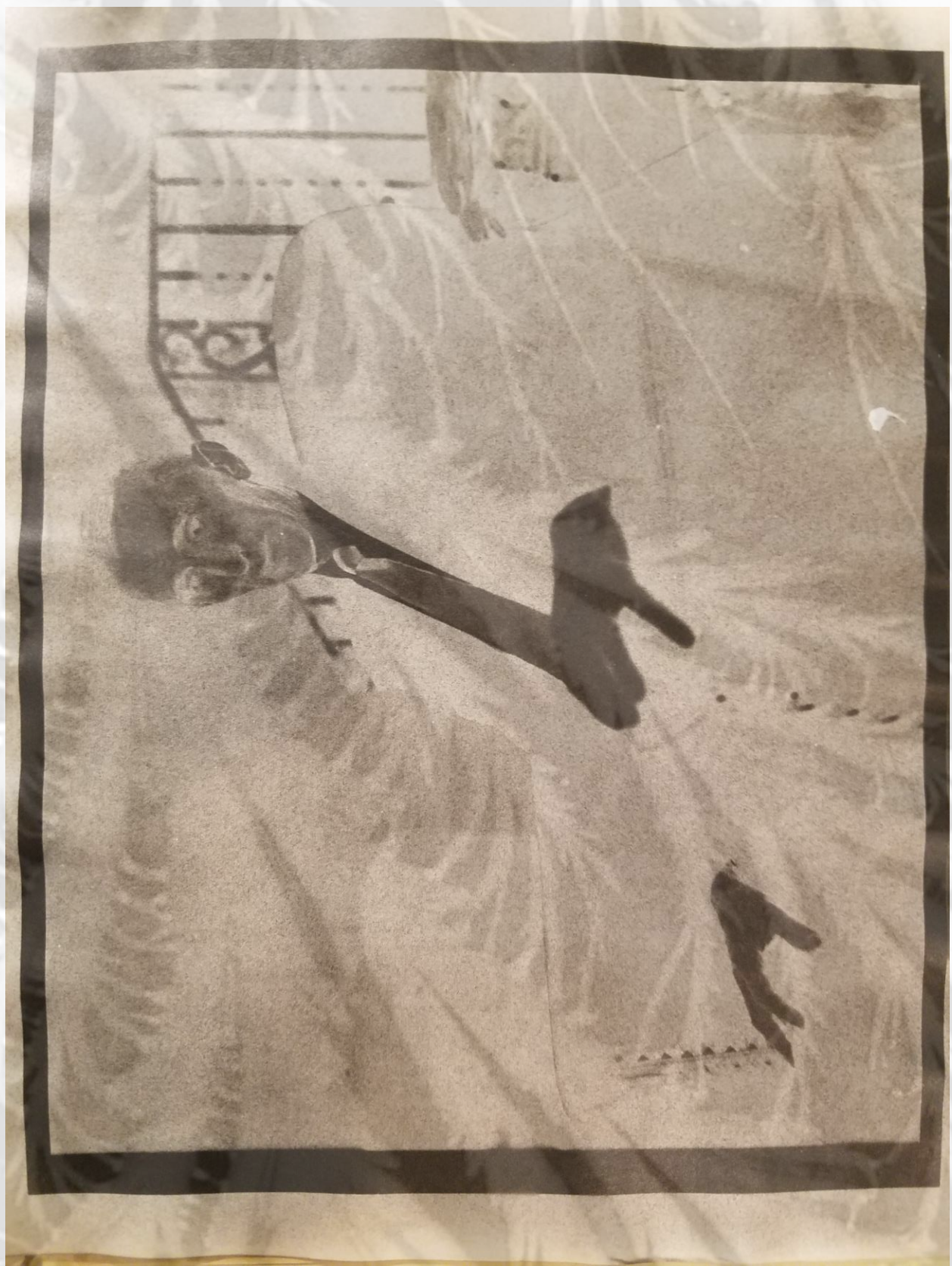
OA-SC No.

B

1499







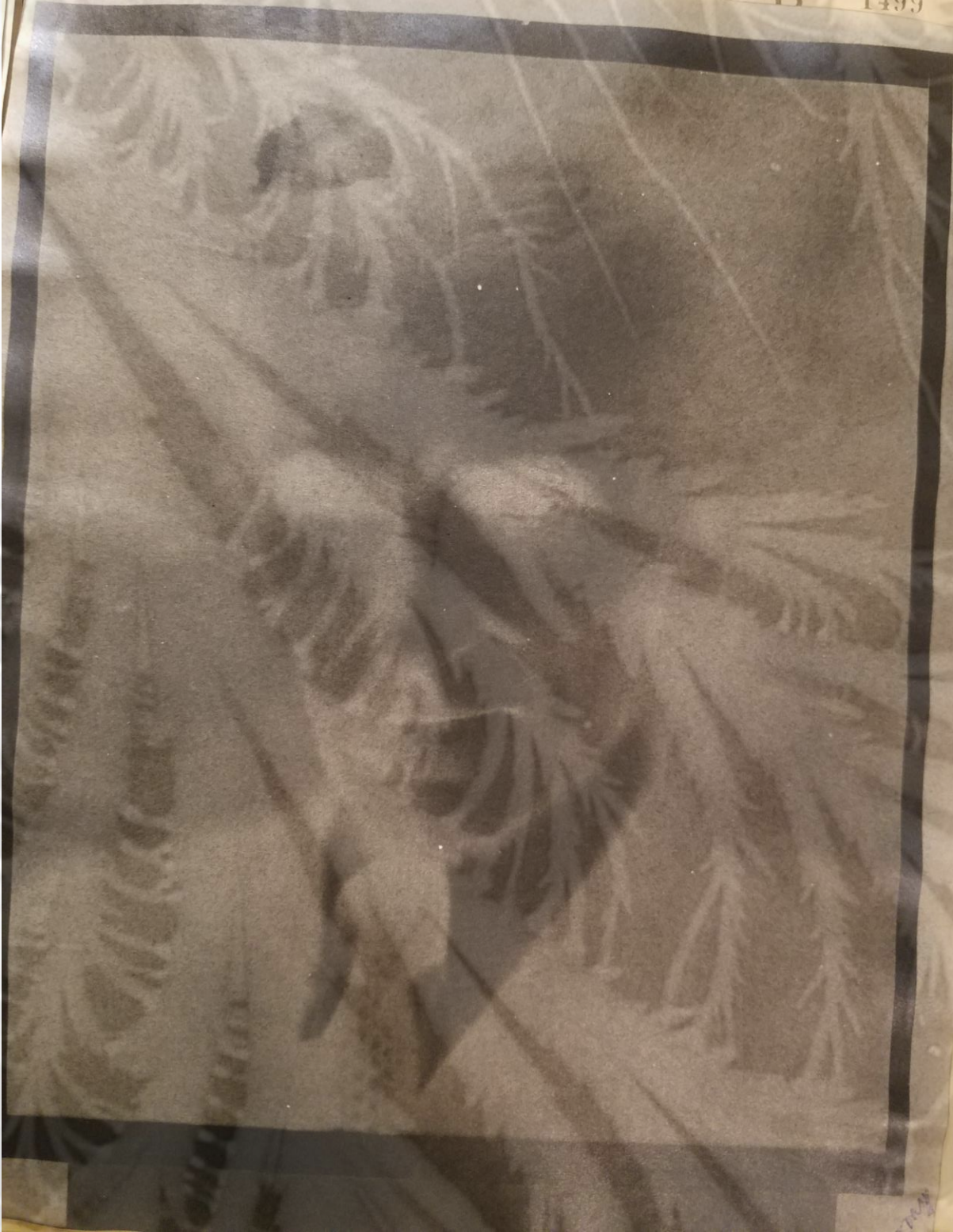


WIDE WORLD PHOTOS, INC.

14 ROCKAWELL PL. NEW YORK 20, N. Y.

Phone 7-1111

CLASS No. B 1499









Oct 13, 1933 - Salary Credit line cut 46





New York, January 1, 1904

I wish to announce that in connection with the commercial introduction of my inventions I shall render professional services in the general capacity of consulting electrician and engineer.

The near future, I expect with confidence, will be a witness of revolutionary departures in the production, transformation and transmission of energy, transportation, lighting, manufacture of chemical compounds, telegraphy, telephony and other arts and industries.

In my opinion, these advances are certain to follow from the universal adoption of high-potential and high-frequency currents and novel regenerative processes of refrigeration to very low temperatures.

Much of the old apparatus will have to be improved, and much of the new developed, and I believe that while furthering my own inventions, I shall be more helpful in this evolution by placing at the disposal of others the knowledge and experience I have gained.

Special attention will be given by me to the solution of problems requiring both expert information and inventive resource—work coming within the sphere of my constant training and predilection.

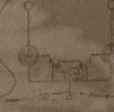
I shall undertake the experimental investigation and perfection of ideas, methods and appliances, the devising of useful expedients and, in particular, the design and construction of machinery for the attainment of desired results.

Any task submitted to and accepted by me, will be carried out thoroughly and conscientiously.

Laboratory, Long Island, N. Y.  
Residence, Waldorf, New York City.

Nikola Tesla

Burning atmospheric nitrogen by high frequency discharge twelve million volts



Some interference from lightning and messages

2nd - UNDEVELOPED, LABORATORY - TESLA'S MARINERS



# UNITED STATES PATENTS GRANTED TO NIKOLA TESLA

334,823	390,820	447,920	514,972	609,250
335,786	396,121	454,622	514,973	609,251
335,787	401,520	455,067	517,900	611,719
336,961	405,858	455,068	524,426	613,735
336,962	405,859	455,069	555,190	613,809
350,704	406,968	459,772	568,176	645,576
359,748	416,192	462,418	568,177	649,621
381,968	416,193	464,666	568,178	11,865
381,969	416,194	464,667	568,179	685,012
381,970	416,195	487,796	568,180	685,953
382,279	417,794	511,559	577,670	685,954
382,280	418,248	511,560	577,671	685,955
382,281	424,036	511,915	583,953	685,956
382,282	433,700	511,916	593,138	685,957
382,845	433,701	512,340	609,245	685,958
390,413	433,702	514,167	609,246	723,188
390,414	433,703	514,168	609,247	725,605
390,415	445,207	514,169	609,248	
390,721	447,921	514,170	609,249	



"In connection with resonance effects and the \*\*\* transmission of energy over a single conductor, \*\*\* I would say a few words on a subject which constantly fills my thoughts, and which concerns the welfare of all. I mean the transmission of intelligible signals or, perhaps, even power, to any distance without the use of wires. I am becoming daily more convinced of the practicability of the scheme; and though I know full well that the great majority of scientific men will not believe that such results can be practically and immediately realized, yet I think that all consider the developments in recent years by a number of workers to have been such as to encourage thought and experiment in this direction. My conviction has grown so strong that I no longer look upon this plan of energy or intelligence transmission as a mere theoretical possibility, but as a serious problem in electrical engineering, which must be carried out some day. \*\*\* In fact, what is there against the carrying out of such a scheme? We now know that electric vibration may be transmitted through a single conductor. Why, then, not try to avail ourselves of the earth for this purpose? \*\*\* Theoretically, it could not require a great amount of energy to produce a disturbance perceptible at great distance, or even all over the surface of the globe. I think that, beyond doubt, it is possible to operate electrical devices in a city, through the ground or pipe system, by resonance from an electrical oscillator located at a central point. But the practical solution of this problem would be of incomparably smaller benefit to man than the realization of the scheme of transmitting intelligence or, perhaps power, to any distance through the earth or environing medium. Proper apparatus must first be produced, by means of which the problem can be attacked, and I have devoted much thought to this subject. I am firmly convinced that it can be done, and hope that we shall live to see it done."—*Light and Other High-frequency Phenomena*.\*

\*Lecture delivered before the Franklin Institute, Philadelphia, February, 1893, and before the National Electric Light Association, St. Louis, March, 1893.

"Electrical effects of any desired character and of intensities undreamed of before are now easily producible by perfected apparatus of this kind \*\*\*. I have produced electrical discharges, the actual path of which, from end to end, was probably more than one hundred feet long; but it would not be difficult to reach lengths one hundred times as great. I have produced electrical movements occurring at the rate of approximately one hundred thousand horse-power, but rates of one, five, or ten million horse-power are easily practicable. In these experiments effects were developed incomparably greater than any ever produced by human agencies, and yet these results are but an embryo of what is to be. That communication without wires to any point of the globe is practicable with such apparatus would need no demonstration, but through a discovery I made I obtained absolute certitude. Popularly explained, it is exactly this: When we raise the voice and hear an echo in reply, we know that the sound of the voice must have reached a distant wall, or boundary, and must have been reflected from the same. Exactly as the sound, so an electrical wave is reflected, and the same evidence which is afforded by an echo is offered by an electrical phenomenon known as a 'stationary' wave—that is, a wave with fixed nodal and ventral regions. Instead of sending sound vibrations toward a distant wall, I have sent electrical vibrations toward the remote boundaries of the earth, and instead of the wall, the earth has replied. In place of an echo I have obtained a stationary electrical wave \*\*\*."—*The Problem of Increasing Human Energy, Century, June, 1900.*

"By the discovery of these facts and perfection of means \*\*\* it becomes possible to transmit \*\*\* electrical energy \*\*\* for industrial uses on a large scale up to practically any amount and, according to all the experimental evidence I have obtained, to any terrestrial distance. \*\*\* The transmitting as well as receiving apparatus may be \*\*\* movable as, when \*\*\* carried by vessels floating in the air or by ships at sea \*\*\*."—*U. S. Patents Nos. 645,576 and 649,621.*





(1)

Dear Mr. Andersen:

Thanks for your note of the 14th. I have been busy with my bread andbutter job here in applications engineering for an electronics jobber. As an older citizen it seems that the better paying engineering jobs are unavailable to us here. The electronics firms are staffed with youngsters who resent an oldsters experience.

I had a letter from Beta. I believe that I met Erwood once when I was seeking to buy some businesses for a wealthy client in Connecticut. I have suggested to him that he might obtain more definite information on the Big Oscillator through you or the Tagliam Museum?

You might write to Mrs. Earle Lewis Ovington, Santa Barbara, California. She is the wealthy widow of my former friend in early day electronics and aviation in New York. Earle became famous as the First Licensed Air Mail Pilot. He and I had Bleriot Monoplanes at Garden City, L.I. in 1909 when they were beautiful little fairy moths that flew at 75 M.P.H. over the heads of the admiring crowds in Sundays much like a circus ar und a track with tall pilons as markers. The first radio two way set was installed in Earle's Bleriot "Dragonfly" at Garden City in 1909. It was a bread board affair. We had lots of fun with it and pioneering the counterpoise antenna which is credited to two others who rediscovered it a year or more later. Although I became one of the first fliers of that day and was a naval flier in 1917 I quit that for radio as that has always been my forte. From the 1890's when I first met Tesla at the Garden in N.Y. and he gave dad and Earle and others a private showing of his radio controlled torpedo boat I was thrilled with the



(2)

radio ideas. I hope to get some good connected story on paper for posterity and documentary purposes so that the younger generation may know what it was like to thrill to the newsets of that day. I have Dr Lee de Forest and old friend and mentor to advise and encourage me. At 80 he is going strong with his newest Heat Machine. EARLE L. DORINGTON WAS ASST. TO TESLA ALSO A FINANCIAL BACKER IN 1895-1910.

I was with the O.S.R.D. and with the R.F.C. briefly

as a consultant. I had original ideas to sell the F.B.I. and called there in Washington but could get no where. They know it all. Apparently they secure advance info on matters which they classify as "knowledge" but it is my belief that they have grabbed "knowledge" that they don't know how to apply?

A number of the so-called secret devices that they are using were old stuff years ago. The much talked of Wrist Watch Radio was built at our lab away back in 1926. Dr. Charles F. Burgess built the first portable in 1920. My friend Louis Pasent had it in his consulting office in N.Y.C. for years as a relic. Burgess and Louis have departed for greener fields beyond the vale, where I have an idea there is plenty of research to be accomplished too.

I am very glad to note of your progress toward a definite start on the Bulletin and the Tesla Journal. If I may be of assistance please let me know. I would like to help if I can?

I am in "a sort of a mess" here with a man whom I befriended <sup>here</sup>. He has a Mineral Ore Selector that separates any mineral from its gangue, electronically. The machine has great possibilities. I have managed to get some of the large mining companies interested. Then I introduced the inventor to men of means who backed him with a token allowance. He is a thoroughly impractical business man and spent the money unwisely. The backers are "peevish" and will not invest more until he shows them all the machine workings.



As this inventor has been cheated before he is so suspicious that he refuses to reveal "the whole secret" to his backers. He has applied for patents through a patent lawyer friend of mine whom I brought into the picture. The backers, the lawyer and the C.P.A. who has the corporation papers can do nothing with the inventor who is stubborn and will not move unless he gets more money. It is an impasse that is embarrassing to me. I am the one who got the whole matter under way and there is nothing that I can do now but try and secure a new backer to take over the present backers who want their money back (\$20,000). In the mean time the inventor runs all over <sup>even to Mesaba-Duluth, Minn.</sup> at the beck and call of the mining companies who are doing their best to steal the idea if they can. The machine is said by big authorities to be one that will revolutionize the whole mining process industry.

I am proposing that some one invest say \$100,000 in a new company to take over the present one that can't get going due to "personality trouble". If you would like more data on the machine let me know. It is an actuality, not a dream. It works. The model is here. The inventor has invested over \$150,000 of his own money and is broke. That money was spent in research prior to the forming of the corporation. Let me know if you have anyone interested enough to want to see the machine and meet the inventor and investigate it thoroughly.

The lady you mention as having called upon O'Neil may have been Mrs. Fritz Lowenstein. He was with Tesla and a pioneer. There were a number of German sympathizers that Tesla knew. There was quite a fuss at the time of W.W. I, for my dad used to dine at a large German restaurant in N.Y. with a man whom he had befriended. (I might say in passing that my grandfather and my dad and I



all have had a great trend toward befriending inventors and technical men. I believe I told you how Grandfather was the original backer of Bell in Salem, but Bell made a flop of the Harmonic telegraph and felt bad because Elisha Gray beat him. That "mistake" made Bell. He had lived at 336 Essex Street, a block away from the Sanders Mansion where he established his first lab in the basement and later in the attic. 336 Essex Street in Salem was built and occupied by my family for five generations and grandfather was always helping others. Dad was of a similar stripe and knew so many of the inventors that (Morse and his wealthy telephone pioneer colleagues backed.) Well Dad used to dine in this German restaurant where he enjoyed the imported beer and there he met this personable red-bearded young man who became his charge. The man spoke English with perfection and had a PH.D. (Heidelberg). He was in the oil business for some German company and dad helped him meet business men. Prior to the war I worked for D.E.B.E.G. and briefly for the Atlantic Communication Co. <sup>BUEN-AYVILLE TRANSATLANTIC STATION</sup> as a consultant I installed radio on the Argentine battle ships Rivadavia and Morena. I was in the N.Y. office and on some German ships under Seelig, Boehme, and others. I knew men like Zennick and Braun and other leaders in Germany. The war broke out. I went into the navy and was forbidden to even mention their names. Dad felt hurt because if his friend in the oil business who had returned to Germany. One day Dad was quizzed by the old F.B.I. and was pretty well peeved at the treatment accorded him - an established business man with two sons on the service and he let them know it too. They finally revealed that his friend who had visited our place in Yonkers was in reality one of the several



(5)

sons of the Kaiser and a Major General in the Army over there.  
I believe he was killed in action.

I will keep you informed as I can.

Sincerely,

John O. Ashton

*John O. Ashton*

2261 St Francis Drive  
Palo Alto, California  
September 22nd, 1953



Letter 10/5/54 to Goldman.

There was no one who worked for Nick who was rarely taken into his confidence. His sketches were always in parts. His records were never complete. He feared pirating. As Louis Pascont [sic], my old chem, and I visit Testa as a quiet-mannered and discrete consulting engineer, he ~~can~~ [Pascont] saw that Nick to be a companion of sorts. They would chat at Nick's penthouse but Louis could get [out] no far. Nick had the peculiar reserve and suspicion that made him a unique figure. There are no others as close to Louis.

I have two rather well. As the sex of a weath' man & the suit - here suits were  
ad. with scale + trans. angles to find the third <sup>as 29</sup>, I did see a lot too, scale count  
<sup>at same distance once by a different.</sup>  
Pander and Cheever, big corn of Obispo Wire, were given  
European mixed ad Turke = a typical European gentleman - scentist  
appeared to them. I worked with Fernandez, another pair type -  
<sup>war come with the water from the type - some</sup>

07-17-55

Pandey and Cheever, two sons of Obomte Wase, were gentle  
European minded and Turke is a typical European gentleman - scientist  
appealed to them. I worked with <sup>Mar come into the active people type -</sup> Fenuke, another "pale" type -

his radio controlled torpedo boat I was thrilled with the



N. Y. Sun, Nov. 8, 1898, p 7, col 1,2

Tesla's New War Wonder

Has Model of Ship Operated by Magnetic Waves from Shore

"Nikola Tesla, whose original discoveries in electrical science during the past ten years have placed him in the foremost ranks of science, and whose application of his discoveries have made him recognized as one of the world's greatest inventors, makes public today his latest discovery and invention, which he believes is also his greatest one. In brief, Mr. Tesla believes that this invention will not only answer many useful purposes in ordinary life, but that it would make war so terrible as well as expensive, as to make it prohibitory, and thus to assure peace between all the nations.."

"The idea of the invention came to Mr. Tesla years ago, and he has never lost sight of it since, but it was not until the war with Spain came and stirred him with patriotism -- for Mr. Tesla is American to the backbone - that the scheme took definite form and shape. Then the idea completely possessed him and gave him no rest until the problem was worked out in its entirety."

In lab at E. Houston St., Tesla has working model of vessel.

S-5, frame 35



Tesla - Telautomata - Rival torpedoes

Letter to RUJ, Columbia College

46 E. Houston St. Feb. 28, 1900

My dear Luka,

...Have you seen in yesterday's Evening Post the reference to the "steering torpedoes"? I will keep low as I did in the Niagara episode, but I am sure the government will come to me.

Swezey card file  
S-4, frame 34



TELAUTOMATON

Letter from Tesla to Sam. Cohen TM

Samuel Cohen,  
Experimenter Publ Co.  
233 Fulton St.  
Mar. 19, 1916

".. sending photos of two of my wireless boats of which smaller one was illustrated in my article in Century. Constructed in '97 and '98. This was long before issue of my patent. In fact, I acquainted a great number of friends with principles of 'telautomatics' in experiments from '92 to '95.

"In smaller machines all apparatus was condensed in space of about 3 feet and it was designed specifically to perform innumerable operations with great precision. Patent does not show full perfection of control because at that time I had not obtained patents on individualizing methods, but I had embodied principles (of these methods) in my telautomaton. Usually, when exhibited, visitors would ask questions they liked and the machine would answer by signs, such as shifting rudder or rotating propeller, or lighting lights, exploding cartridges, firing revolvers, etc. At that period I also designed automobile automaton with several novel features.

see: Electrical Review (NY) Nov. 9, 16, and dec 7, 1898

from Swezey card file  
S-3



## TELAUTOMATON

N. Y. Sun, Nov. 8, 1898, p 7, col 1,2

Tesla's New War Wonder

Has Model of Ship Operated by Magnetic Waves from Shore

"Nikola Tesla, whose original discoveries in electrical science during the past ten years have placed him in the foremost ranks of science, and whose application of his discoveries have made him recognized as one of the world's greatest inventors, makes public today his latest discovery and invention, which he believes is also his greatest one. In brief, Mr. Tesla believes that this invention will not only answer many useful purposes in ordinary life, but that it would make war so terrible as well as expensive, as to make it prohibitory, and thus to assure peace between all the nations.."

"The idea of the invention came to Mr. Tesla years ago, and he has never lost sight of it since, but it was not until the war with Spain came and stirred him with patriotism -- for Mr. Tesla is American to the backbone - that the scheme took definite form and shape. Then the idea completely possessed him and gave him no rest until the problem was worked out in its entirety."

In lab at E. Houston St., Tesla has working model of vessel.

S-5, frame 35



TELEAUTOMATON

Phila. Press May 1, 1898

(Interview concerning device for telegraph to warships 100 miles away)

Nikola Tesla's Revolution in War Telegraphy

Interviewed concerning ideas on war with Spain:

"One reason I cannot tell you just what my machine is, is that if it can be used on our ships it will give us an advantage; and I shall be proud to have been of so much use to my country."

"Then you consider yourself a good American?"

The inventor threw up his hands and looked incredulous at the suggestion of doubt.

"I a good American?" he said, "I was a good American before I ever saw this country. I had studied its government; I had met some of its people, I admired America. I was at heart an American before I thought of coming here to live."

"What opportunities this country offers a man! Its people are a thousand years ahead of the people of any other nation of the world. They are big, broadminded, generous. I could not have accomplished in any other country what I have here."

"...The American people are quick to hold out a helping hand and to give recognition. Yes I am as good an American as there is. I have nothing to sell the government of the U. S. If it needs my service in any way it is welcome to them."

From Swezey card file  
S-3

DUPLICATE



Robert Uck called 97/10/12

Natalie Steiful (Dep.) <sup>Journalist +</sup> L.T. Hinton <sup>of the boat</sup>

He met a man who witnessed a demo in  
1901 to the Japanese + they wanted to buy it  
+ took it away. (Hinton up on the boat.)

Also, he said some boys who remembered the  
Walrus. He went took the boat + tried  
to launch it in L.T. Pond. It sank.



Basura 97/11/21  
NATIONAL AIR AND SPACE MUSEUM

SMITHSONIAN INSTITUTION

WASHINGTON, D. C. 20560

October 1, 1976

Mr. Nick Basura  
3414 Alice Street  
Los Angeles, California 90065

Dear Mr. Basura:

Thank you for your recent letter of inquiry concerning the radio-controlled boat of Nikola Tesla. While this invention was indeed remarkable, as far as we can determine it did not directly lead to current guided missile technology, though in a sense it may have been a precursor.

The guided missile as we know it is the result of many technologies which are often difficult and sometimes impossible to trace to their original sources. Radio-controlled rockets were experimented upon by the Englishman A.M. Low during World War I; James Rumsey apparently experimented with reaction-propelled boats about 1787; and Conrad Haas of Sibiu (in what is now Rumania) designed and perhaps built multi-stage rockets about 1529. It would be wholly fallacious, however, to state that these achievements led to modern rocket-propelled guided missiles or multi-stage space vehicles.

Rather, modern guided missile technology was largely developed during World War II, though admittedly based upon an already ancient invention--the rocket. (Other forms of propulsion were, of course, also developed during this time.) Guidance and stabilization methods are particularly difficult to trace historically, though Dr. Ernst A. Steinhoff has written a paper entitled "Early Developments in Rocket and Spacecraft Performance, Guidance, and Instrumentation," and published in Smithsonian Annals of Flight, No. 10. A copy is enclosed.

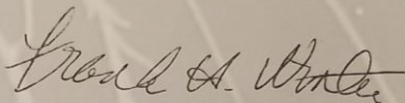
We might also suggest that you consult Rockets, Missiles and Men in Space by Willy Ley and History of Rocketry and Space Travel by Wernher von Braun and Frederick I. Ordway, III. These works are standard histories of rocketry, spaceflight, and guided missiles and should be available in your local public library. Neither of these works, as well as similar histories, acknowledge Tesla as the originator of the guided missile.



Nonetheless, we do appreciate the genius of Tesla and maintain a biographical file on him. We would, therefore, be most interested to learn of any additional sources you may have.

We thank you again for your interest in the National Air and Space Museum.

Sincerely,



Frank H. Winter  
Research Historian  
Astronautics

Enclosure



No. 613,809.

Patented Nov. 8, 1898.

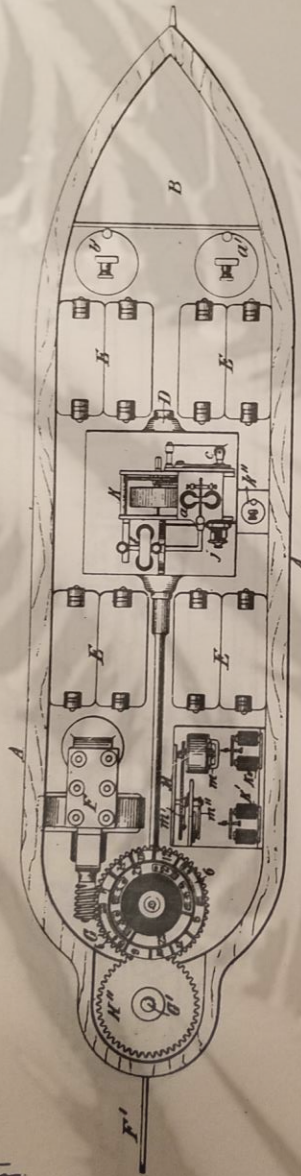
N. TESLA.

METHOD OF AND APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS  
OR VEHICLES.

(No Model.)

5 Sheets—Sheet 1.

Fig. 1



Witnesses:  
Raphael Tetter  
George Schuff.

Inventor  
Nikola Tesla



No. 613,809.

N. TESLA.

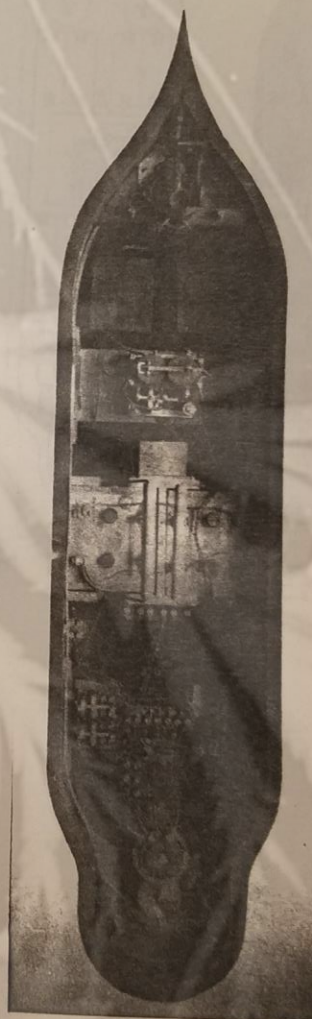
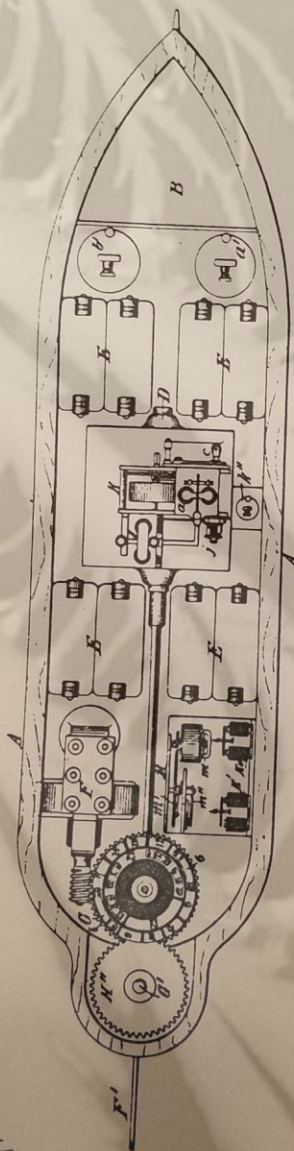
Patented Nov. 8, 1898.

METHOD OF AND APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS  
OR VEHICLES.

(No Model.)

5 Sheets—Sheet 1.

Fig. 1



Witnesses:

Raphael Ketter  
George Scherff.

Inventor:

Nikola Tesla



TELEAUTOMATON

Phila. Press May 1, 1898

(Interview concerning device for telegraph to warships 100 miles away)

Nikola Tesla's Revolution in War Telegraphy

Interviewed concerning ideas on war with Spain:

"One reason I cannot tell you just what my machine is, is that if it can be used on our ships it will give us an advantage; and I shall be proud to have been of so much use to my country."

"Then you consider yourself a good American?"

The inventor threw up his hands and looked incredulous at the suggestion of doubt.

"I a good American?" he said, "I was a good American before I ever saw this country. I had studied its government; I had met some of its people, I admired America. I was at heart an American before I thought of coming here to live."

"What opportunities this country offers a man! Its people are a thousand years ahead of the people of any other nation of the world. They are big, broadminded, generous. I could not have accomplished in any other country what I have here."

"...The American people are quick to hold out a helping hand and to give recognition. Yes I am as good an American as there is. I have nothing to sell the government of the U. S. If it needs my service in any way it is welcome to them."

From Swezey card file  
S-3

DUPLICATE



TELAUTOMATON

N. Y. Sun, Nov. 8, 1898, p 7, col 1,2

Tesla's New War Wonder

Has Model of Ship Operated by Magnetic Waves from Shore

"Nikola Tesla, whose original discoveries in electrical science during the past ten years have placed him in the foremost ranks of science, and whose application of his discoveries have made him recognized as one of the world's greatest inventors, makes public today his latest discovery and invention, which he believes is also his greatest one. In brief, Mr. Tesla believes that this invention will not only answer many useful purposes in ordinary life, but that it would make war so terrible as well as expensive, as to make it prohibitory, and thus to assure peace between all the nations.."

"The idea of the invention came to Mr. Tesla years ago, and he has never lost sight of it since, but it was not until the war with Spain came and stirred him with patriotism -- for Mr. Tesla is American to the backbone - that the scheme took definite form and shape. Then the idea completely possessed him and gave him no rest until the problem was worked out in its entirety."

In lab at E. Houston St., Tesla has working model of vessel.

S-5, frame 35



TELAUTOMATON

Letter from Tesla to Sam. Cohen TM

Samuel Cohen,  
Experimenter Publ Co.  
233 Fulton St.  
Mar. 19, 1916

".. sending photos of two of my wireless boats of which smaller one was illustrated in my article in Century. Constructed in '97 and '98. This was long before issue of my patent. In fact, I acquainted a great number of friends with principles of 'telautomatics' in experiments from '92 to '95.

"In smaller machines all apparatus was condensed in space of about 3 feet and it was designed specifically to perform innumerable operations with great precision. Patent does not show full perfection of control because at that time I had not obtained patents on individualizing methods, but I had embodied principles (of these methods) in my telautomaton. Usually, when exhibited, visitors would ask questions they liked and the machine would answer by signs, such as shifting rudder or rotating propeller, or lighting lights, exploding cartridges, firing revolvers, etc. At that period I also designed automobile automaton with several novel features.

see: Electrical Review (NY) Nov. 9, 16, and dec 7, 1898

from Swezey card file  
S-3



N. Y. Sun, Nov. 8, 1898, p 7, col 1,2

Tesla's New War Wonder

Has Model of Ship Operated by Magnetic Waves from Shore

"Nikola Tesla, whose original discoveries in electrical science during the past ten years have placed him in the foremost ranks of science, and whose application of his discoveries have made him recognized as one of the world's greatest inventors, makes public today his latest discovery and invention, which he believes is also his greatest one. In brief, Mr. Tesla believes that this invention will not only answer many useful purposes in ordinary life, but that it would make war so terrible as well as expensive, as to make it prohibitory, and thus to assure peace between all the nations.."

"The idea of the invention came to Mr. Tesla years ago, and he has never lost sight of it since, but it was not until the war with Spain came and stirred him with patriotism -- for Mr. Tesla is American to the backbone - that the scheme took definite form and shape. Then the idea completely possessed him and gave him no rest until the problem was worked out in its entirety."

In lab at E. Houston St., Tesla has working model of vessel.

S-5, frame 35

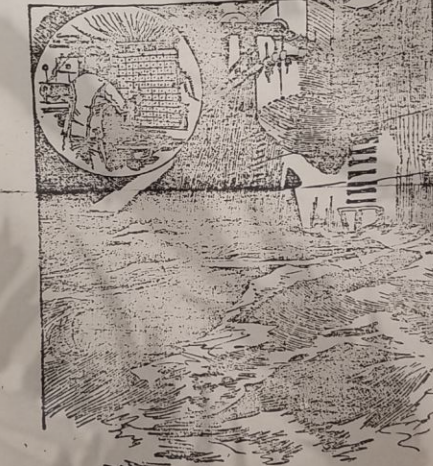


# Electricity to Guide Torpedoes

## Principle of Wireless Telegraphy to Make Engines of Destruction Certain in Their Work.

LONDON, Sept. 21.—(Special Correspondence.)—The Republic—At last a means has been discovered of guiding a torpedo on its mission of death. The principle of wireless telegraphy is to be applied to the steering of these submarine infernal machines, and, according to those who have examined the invention, this plan has been found to work so well that the torpedo may be reckoned among the heaviest thunderbolts of war, instead of being, as heretofore the jest of naval experts. A brief announcement of this important discovery has been cabled over, but a detailed description of the torpedo as it appears upon its action have been kept very secret.

The invention consists of an application of the electric waves just as in wireless telegraphy, operating very precisely for metallic connection between the torpedo and the torpedo boat. To understand the plan of procedure it must be remembered that an iron rod is sucked into a coil of



GLIDING A TORPEDO BY ELECTRICAL WAVES.

wire, when an electric current traverses the spiral in a suitable direction. The torpedo is provided with two staffs which project above the surface of the water and can receive electric waves passing them through the air, and generated by an apparatus on the torpedo boat. To the rudder-head of the torpedo are attached two coils of wire with two cores of iron near them. When an electric current passes round the coils in one direction, one of the cores is sucked in, while if the current circulates in the other direction the other core enters its spiral. Suppose the torpedo leaves its proper course. It is at once righted in the following way: Electric waves are developed on the torpedo boat, pass through the air, and are received by the staffs attached to the torpedo. These by a simple apparatus are made to develop an electric current in the coils of wire, and one or the other of the iron cores, as occasion requires, is sucked into its coil, and this movement turns the helm of the torpedo. When the torpedo has reached its proper course the waves from the controller are stopped. The invention will render it possible to cause a torpedo to move in any direction almost as if it were possessed of a separate intelligence.

**Will Follow Its Victim.**

That statement is not an exaggeration. The torpedo of the future will actually be made to follow the direction of the ship it seeks to fasten to and destroy. If the torpedo is seen by those aboard this ship and a frantic effort is made to escape the direct line of discharge it will be useless, for the nose of the torpedo will be immediately turned by those aboard the torpedo boat in the new direction taken by the hostile ship, and after that, which

VI. No. 550.

ant with its ex-  
ted for the con-  
\$134.57. In the  
the same man-  
the figures are  
thead contracts  
n the corrected  
irect lights and  
rected average  
Mr. Matthews  
namely, \$127.75  
or when all the  
represented in  
lower than the  
ed by the mu-  
than the cost  
d by the mu-  
les. The prices  
by the Missouri  
dison Co., and  
by a new com-  
comes out as

Price per light  
vacuum corrected  
for conditions  
existing in Boston.

.....	\$127.25
.....	134.57
.....	154.50
.....	129.40
.....	128.43
.....	99.67
.....	110.89
.....	154.08
.....	122.08
.....	143.33
.....	139.90

surely satisfac-  
on plant after  
at it has most  
in investment.  
compiled re-  
ch, and pre-  
Government."  
te companies.  
out municipal  
that came in  
ures. For ex-  
depreciation;  
a fool's para-  
le, Ind. says:  
did not, for in  
y, Ind. says:  
it was run in  
ry unsatisfac-  
bought it best  
nal cost was

st fascinating  
is such as to  
entific public  
tigations and  
op the theory  
ld have been  
pen that none  
is discoveries  
l. We cannot  
guished scien-  
columns this  
nation outrun  
sunbug. Mr.  
launches forth

**Makes Results Certain.**

Now all this is changed. When the tor-  
pedo is fired from a vessel's side it drops  
into the water at a distance of fifteen  
feet, dives about twenty feet, and then  
shoots up and goes through the water  
like a fish for a distance of about half a  
mile, which distance it covers in about  
a minute. It is a costly missile and the Brit-  
ish naval officers have always thought it  
of doubtful effectiveness in warfare. With  
the "Whitehead" guided by electric  
waves, however, it is realized that the  
torpedo takes on a new and formidable  
aspect that places it in an entirely new  
category among weapons of war.

Whether or not the same principle that  
directs the torpedo from the vessel that  
launches it could be used by those on  
board the threatened ship to turn it back  
on those who fired it, is another inter-  
esting problem that presents itself at the  
beginning of speculative thinking on this  
subject. It is almost certain that some  
method of defence will be found by in-  
genious minds against the newly-found  
means of blowing up ships.



# THE ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.  
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - 700 Fisher Building.  
PHILADELPHIA OFFICE, - - - - - 1100 Betz Building.

## Terms of Subscription.

United States, Canada and Mexico,	per year, \$3.00
Four or more Copies in Clubs (each),	" 2.60
Great Britain and other Foreign Countries within the Postal Union,	" 6.00
Single Copies,	" .10

[Entered as second-class matter at the New York Post Office, April 9, 1888.]

Vol. XXVI. NEW YORK, NOVEMBER 17, 1898. No. 550.

## Prices for City Arc Lights.

INQUIRY having been made of us as to the new contract for city lighting in Boston and the data upon which it was based, we may say with reference to that interesting and important subject, that the agreement was entered into last August and runs for ten years, as already noted in our columns. It provides for the use of enclosed arc lights of 2,000 c. p. and the scale of rates is as follows:

Number of lights.	Price per night.	Price per year.
Not less than 2,365 nor more than 2,749	35	\$127.75
" " 2,750 " " " 2,999	34½	125.92
" " 3,000 " " " 3,249	34	124.10
" " 3,250 " " " 3,499	33½	122.27
" " 3,500 " " " 3,749	33	120.45
" " 3,750 " " " 3,999	32½	118.62
" " 4,000 " " " 4,249	32	116.80
" " 4,250 " " " 4,499	31½	114.97
" " 4,500 " " " 4,750	31	113.15
" " 4,750 " " " 4,999	30½	111.32
" " 5,000 " " "	30	109.50

This scale is subject to submission to arbitrators and to revision in favor of the city from time to time, if investigation shows the prices to be capable of reduction, due allowance being made for not less than 7 per cent. for depreciation and 6 per cent. for fixed charges. These arbitrators have the ability to force on the company the adoption of any new system or device that shall have shown itself useful as a means towards the reduction of cost.

This is certainly a notable and remarkable contract, breathing the spirit of equity, and embodying to the full all those modern ideas which regard corporations no longer as bodies of men allied solely for purposes of mutual profit but as servants of the public protected and fostered only so long as the State can derive direct as well as indirect benefit and recompense as a partner in the concern. Aside from these politico-economic and philosophical points, however, there is some very practical satisfaction in the evidence that the contract was warranted by, if not indeed largely based upon, the report of ex-Mayor N. Matthews, Jr., employed as special counsel by the city to tell it how much it ought to pay for electric lighting. That gentleman made one of his thoroughgoing studies of the question, and reinforced his own conclusions by the advice of acknowledged and disinterested experts. What he informed his successor, the Mayor of Boston, was that the average price per light per annum

is \$127.25; in the case of the Detroit municipal plant, with its expenses reduced to a commercial basis, and corrected for the conditions obtaining in Boston, the price would be \$134.57. In the case of the Chicago municipal plant, corrected in the same manner, \$154.80. For the Chicago Edison Company the figures are \$129.20 and \$128.43 for the underground and overhead contracts respectively; St. Louis gets its light for \$99.67 on the corrected basis; Cincinnati for \$110.89; Baltimore \$154 for street lights and \$122.68 for park lights; in Philadelphia the corrected average price is \$143.33, and in New York it is \$139.90. Mr. Matthews therefore holds that the price charged in Boston, namely, \$127.75 for street and \$124.10 for park lights per annum, or when all the differences in local conditions capable of being represented in dollars and cents are taken into account, slightly lower than the cost on a commercial basis of the lights furnished by the municipal plant in Detroit and considerably lower than the cost on a commercial basis of the lights furnished by the municipal plant in Chicago, is very fair to all parties. The prices are considerably higher than the prices charged by the Missouri Edison Co., of St. Louis, and the Cincinnati Edison Co., and slightly higher than those charged in Baltimore by a new competing company for park lights. The summary comes out as follows:

## SUMMARY.

City.	Price per light per annum corrected for conditions obtaining in Boston.
Boston (average price).....	\$127.25
Detroit municipal plant (on commercial basis).....	134.57
Chicago municipal plant (on commercial basis).....	154.80
Chicago (company) (underground contract).....	129.20
Chicago (company) (overhead contracts).....	128.43
St. Louis.....	99.67
Cincinnati.....	110.89
Baltimore, street lights.....	154.08
Baltimore, park lights.....	122.68
Philadelphia (average price).....	143.33
New York.....	139.90

Of course, in preference to this equitable and surely satisfactory contract, Boston might have put in its own plant after going through the conditions required by law, but it has most wisely decided not to venture into that uncertain investment. It finds warrant for such decision in some figures compiled recently by Alderman Wesley Sears, of Jackson, Mich., and presented prominently in the October issue of "City Governments," a journal which has certainly no bias towards private companies. Mr. Sears tried hard to get all the data he could about municipal plants, and he gives a lot of it, but the comments that came in are even more interesting and striking than the figures. For example, Bloomington, Ill., says: "We figure no depreciation; neither do we figure interest, because," etc. What a fool's paradise those city officials must live in! Crawfordville, Ind., says: "We do own our light, but if we did not, we would not, for in my opinion it will bankrupt us." Michigan City, Ind., says: "The time our city owned the electric light plant, it was run in connection with our waterworks. It was run very unsatisfactorily, and the plant had run down. Our council thought it best to sell. We got \$3,000 for same. Think original cost was \$8,600." And so it goes.

## Mr. Tesla and the Czar.

THE personality of Mr. Tesla is one of the most fascinating in the field of modern invention, and his work is such as to command the interest of both the lay and the scientific public whenever he chooses to give details of his investigations and researches. If he had never done more than develop the theory and practice of the multiphase system, his life would have been useful above the ordinary; and even should it happen that none of his other ideas ever get into practical shape, his discoveries in electricity must always be regarded as important. We cannot number ourselves among those who, like the distinguished scientists, Profs. Brackett and Dolbear, quoted in our columns this week, are impatient with his tendency to let imagination outrun achievement and who virtually class him as a humbug. Mr. Tesla fools himself, if he fools anybody, when he launches forth



into the dazzling theories and speculations associated with his name. That he should desire to benefit the human race in ways now unknown, and should avow out loud belief in his capacity to do so, is surely not discreditable, any more than it is unworthy in the head of his own poetic Slavic race to propose the disarmament of the world. Granted that there will still be wars, and granted that all these wonderful visions of new arts in peace do not fructify without the work of a score of later geniuses, why find fault either with the Czar or with Mr. Tesla? Their aims appear wholly noble, their thoughts are beautiful, and if they fail, as they probably will in some material and vital respects, the world is certainly none the worse off for what they actually accomplish.

Just of late Mr. Tesla has been giving publicity to some of his newest work, and it is peculiarly interesting. We should have been glad, personally, to see him finish up some of the many other things that have occupied his energies these ten years past, but none of which now claim any place. For example, his "oscillator," or combination of generator and steam engine, which was to wipe out all other methods of power generation and reduce vastly the cost of power, by steam and electric economies. The very name is now bestowed by Mr. Tesla on another piece of apparatus, and though illustrated in detail and brought before the Chicago Electrical Congress in 1893, the "oscillator" of the original brand is, for aught the public knows, in the scrap heap. Yet it was a lovely invention, of infinite possibilities. We can only regret its neglect and oblivion, but if Mr. Tesla has other things more appealing to his mind for the present, that is his own business.

Of late also Mr. Tesla has brought forward another plan of power generation and transmission. At one period he expressed his belief in ability to disturb the earth's charge and thus send currents through the earth. That does not appear to be so feasible or attractive now as the idea of using the upper strata of the air which he says have a very superior conductivity. He would tether up aloft balloons in those strata and deliver to them large quantities of current at such high potential that it would travel economically across the space without wires, say from Niagara Falls to Paris. By this facile distribution of water power, coal and steam would become unnecessary to industry. The new plan may explain why Mr. Tesla has abandoned his old steam oscillator. It is earnestly to be hoped that this novel idea will prove workable. Balloons were a dismal failure in our late war, but that is no criterion, and Mr. Tesla may have some superior gas for inflation and sustentation purposes. It will be remembered that Mr. Marconi has already telegraphed from balloon to balloon, without wires, a distance of over twenty miles, thus proving in advance the tenability of Mr. Tesla's proposition.

The tremendous hold that war has taken upon the public mind is shown by the fact that even a genius of Mr. Tesla's independence is compelled to invention in that field. A patent issued to him last week intimates that he believes that torpedos and torpedo boats which were so utterly useless and unmanageable in the late conflict with Spain can be made more valuable if controlled entirely from shore, by a Navy Board, and without any crew. Last spring the ability to explode floating torpedos under ships from a distance without any wires was brilliantly demonstrated at Madison Square Garden several times a day for a month. Taking that idea, Mr. Tesla has applied the same principle to the electro-mechanical steering of torpedos, just as it is now done with several types, but, of course, in his case, without the intervening wires from shore. He is very sanguine that this will stop war, and we pray heartily that it may. The article or patent digest we print in this issue on the subject suggests improvements of his on existing apparatus that may render it, in spite of its great delicacy, able to evade jarring and jolting, the perils of the open sea, the defensive network crinolines around the ships, the concussions of great guns, and the intentional explosion of defenses placed in its way thus to derange and negative its operation. During the late war, apparatus far less sensitive than coherers was rendered useless by the firing of the heavy artillery on the ships, and it must be a preternaturally tough coherer that would escape the same fate. So also it must be a very difficult problem for which Mr. Tesla cannot suggest half a dozen diagrammatic solutions.

While all these curious things are "in the air," so to speak, it is a distinct pleasure to be able to print, as we do in this issue, Mr. Tesla's able and thoughtful paper read before the Buffalo meeting of the American Electro-Therapeutic Association. It compensates for the disappointment experienced from his un-

finished lecture two years ago before the New York Academy of Sciences, which has never found its way into print, but of which the opening passages indicated the covering of the same ground. We trust that the data given by Mr. Tesla may stimulate our medical friends to greater employment of electricity. It is unsome of them of Prof. Röntgen's great discovery of the X-ray have made medical men fight shy of handling electricity themselves lately, and we do not know whether Mr. Tesla's experiments will altogether reassure them, so striking and far-reaching are they. But the saving of human life is a sacred thing. Every means and instrumentality must be tried by the surgeon and the physician, and it is devoutly to be hoped that having stopped the slaughter due to war Mr. Tesla will revert at some time to this brilliant paper and give the doctors apparatus that will help prevent the slaughter due to accident and disease.

It is not our desire to pose as apologists or publicists for Mr. Tesla. He needs no assistance of that kind; and so long as he commands freely whole pages of the Sunday papers, for which Mr. Wanamaker pays gladly his thousands of dollars, the technical and scientific journals have, indeed, little to do with the matter. All we wish to say is that it is not fair to condemn, as so many do, Mr. Tesla as visionary and impractical. No man has finished his work till he is dead, and even then there are long, long centuries in which his ideas can prove themselves true. The visionaries are thus often, in the end, the most sordid of realists—something Mr. Tesla will never be.

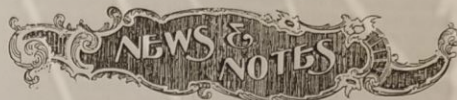
#### A Timely Warning.

IN our columns last week we printed an abstract of a very interesting paper read before the International Association of Fire Engineers, at St. Louis, by Capt. W. Brophy on the serious fire dangers of apparatus for showing animated pictures, which recalled to our minds the terrible Paris calamity of a few years ago. That this warning of Capt. Brophy, who has made the subject of fire protection a life study, is a timely one and deserving of immediate action on the part of local authorities, was evidenced last week by a fire in Huber's Museum and Theater, New York City, caused by the burning out of a fuse in a cinematograph. At the time the fire was started, about two thousand persons were in the building and it seems a miracle that no one was seriously hurt in the panic which resulted and which quickly emptied the house. It was a serious lesson, however, for the Board of Fire Underwriters, who should insist, as Capt. Brophy stated, that in the wiring of these machines and their construction the rules in the "National Code" must be complied with.

THE recent treatment of their employes by many companies during the war with Spain bore evidence, if it were needed, that there are corporations with souls. Such instances of patriotism and generosity were numerous. In the case of the Chicago Edison Co. not only were the men who went to the front carried on the pay rolls, but when they came back the president—an Englishman, at that—gave them a rousing banquet at his own expense. Now, during the yellow fever troubles down South, we note corresponding action on the part of the Postal Telegraph Co., which has made personal to itself the welfare of every one of its employes stricken down at the post of duty and has provided all medical aid and every needed comfort. It has, we understand, gone even further than that, but this record of fact will suffice to show how humane are the sentiments pervading the management. The company has sought no publicity in this respect, but that simply adds to the merit of this action. So shines a good deed in this suffering world.

AN item has been in circulation to the effect that Mr. Thomas A. Edison is going to make a trip to Russia, where several learned societies are waiting to do him honor. We have no doubt as to the attitude of our Russian friends, but the item is not true. We have been requested to make a positive contradiction of it in Mr. Edison's name, and now do so. Mr. Edison not only is not going to Russia, but he has no idea how the story originated.





### The Baggett Fuse Repair Screw Driver and Portable Lamp Socket.

ANYONE who has ever been called upon to insert a fuse into a fuse block located on a ceiling or some other place, difficult of access, especially when the place was dark, has felt the necessity for a handy tool and a light to aid him in performing this tedious operation. Such a tool, which seems to fill this long-felt want most admirably, has lately been placed on the market by James N. Baggett, superintendent of the Bartow Electric Light Works, of Bartow, Fla., and is illustrated below.

It includes all of the requisites for enabling an operator to tap a live wire in order to give light during the making of branch connections and the effecting of repairs. It consists of a screw driver, shown in perspective in Fig. 2, which has a detachable base. The handle, which is hollow, contains the necessary fuses

### Tesla's Electrical Control of Moving Vessels or Vehicles from a Distance.

IN view of the public interest of late in anything which has a warlike appearance or apparatus tending to render war less probable by making it more horrible and destructive, and in view also of numerous recent disasters at sea, the current descriptions in the daily papers of a new invention of Mr. Tesla and reported interviews with him have been received with widely differing comments. In Mr. Tesla's own words, the invention consists of a complete and practicable solution of the problem of controlling from a given point the operation of the propelling engines, the steering apparatus and other mechanism carried by a moving object, such as boat or floating vessel, whereby the movement and the course of such a vessel may be directed and controlled from a distance, and any de-



Fig. 1.—Cap Removed and Lamp Attached.

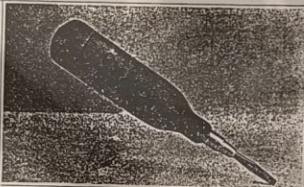
Fig. 2.—Screw Driver with Contents Enclosed.  
BAGGETT FUSE AND REPAIR OUTFIT.

Fig. 3.—Replacing a Blown Out Fuse.

and clamps, shown in Figs. 1 and 4, for tapping the legs of the circuit. These clamps can be connected to the lamp-plug socket, which is the base of the handle itself, by means of plugs, and the operator by inserting a lamp into this socket will have the advantage of a light even during the operation of inserting a fuse. The manner of using the tool and attaching the clamps to the wires is clearly shown in Figs. 3 and 4. The tool has been

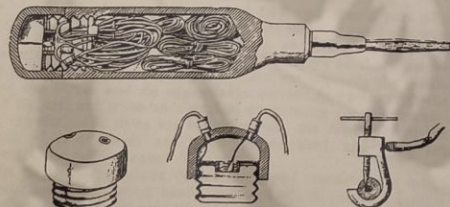


FIG. 4.—BAGGETT FUSE REPAIR SCREW DRIVER, CASE REMOVED, ALSO LAMP CAP AND WIRE CLAMP.

constructed with the end in view of embodying in the smallest possible space all the necessary implements, and should find a ready market among wiremen and engineers.

A RAT IN DUBLIN, by gnawing at the insulation on one of the cables, is said to have short-circuited a section of the electric lighting system. Its life was the penalty, but the cable would not appear to have been very heavily protected.

LITTLETON, N. H. The Littleton Water and Electric Light Company has utilized water power, putting in Rodney Hunt twin 39-inch turbines, developing about 350 h. p. under 18-foot head, and driving a plant of the Stanley two-phase system. The cost is about \$25,000.

vice carried by the same brought into action at any desired time. The system is based on the use, upon the object to be exploded or steered, of a Branly coherer and Marconi agitator of novel form, toward which impulses are sent from a Hertzian radiator. It will be remembered that this is what was done in a small but very successful way at the Electrical Exhibition in Madison Square Garden last May, when miniature floating torpedoes fastened on a board floating under the bottom of model men-of-war were thus blown up daily, without wires, by means of the same "wireless telegraph" methods, from a distance of not less than 50 or 60 feet. Mr. Tesla's application is dated in July. It was one of the intentions at the exhibition to place all the receiving apparatus on the boat in the water; but for obvious reason pertinent to the locality it was found desirable to run the boat connections to a temporary shelf at the top edge of the tank and rest the cohering apparatus there; so that the floating mines or torpedoes could be renewed frequently and also to prevent the boat from floating about, as one or two people were hurt by flying pieces when the explosions took place too near the sides. Another object was to prevent the continuous destruction of the coherers, being delicate and expensive apparatus then not readily obtainable. Mr. Tesla in his scheme embodies the idea of placing the coherer on the floating torpedo, and proposes that the impulses taken up by the coherer shall also operate steering magnets, as in other dirigible torpedoes, such as the Sims-Edison, but without the wires to shore. This method he elaborates with wonted ingenuity, although he does not include the firing of artillery, which was also done last May at the exhibition, and of course might be done with equal facility on a floating ship, without wires from the shore; or on a submerged fort or an uninhabited monitor at a harbor entrance. His patent is limited merely, it would appear, to devices or mechanism for steering, and does not claim either the discharge of explosives or selective signaling, or other features of that kind.

Referring to Fig. 1, A designates any type of vessel or vehicle which is capable of being propelled and directed, such as a boat, a balloon, or a carriage. It may be designed to carry in a suitable compartment B objects of any kind, according to the nature



of the uses to which it is to be applied. The vessel—in this instance a boat—is provided with suitable propelling machinery, which is shown as comprising a screw propeller C, secured to the shaft of an electromagnetic motor D, which derives its power from storage batteries E E E E. In addition to the propelling engine or motor the boat carries also a small steering motor F, the shaft of which is extended beyond its bearings and provided with a worm which meshes with a toothed wheel G. This latter is fixed to a sleeve b, freely movable on a vertical rod H, and is rotated in one or the other direction, according to the direction of rotation of the motor F.

The sleeve b on rod H is in gear, through the cog-wheels H' and H'', with a spindle G, mounted in vertical bearings at the stem of the boat and carrying the rudder F'.

The apparatus by means of which the operation of both the

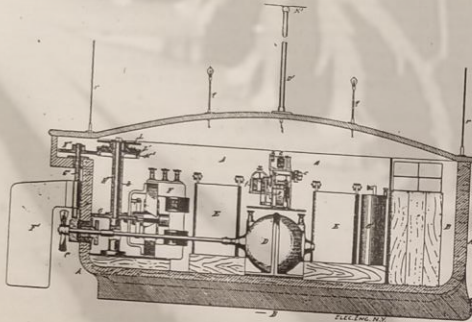


FIG. 1.

propelling and steering mechanisms is controlled involves a receiving circuit, adjusted and rendered sensitive to the influence of waves or impulses emanating from a remote source, the adjustment being so that the period of oscillation of the circuit is either the same as that of the source or a harmonic thereof.

The receiving circuit proper (diagrammatically shown in Fig. 2) comprises a terminal E', conductor C', a sensitive device A', and a conductor A'', leading to the ground conveniently through a connection to the metal keel B' of the vessel. The terminal E' should present a large conducting surface and should be supported as high as practicable on a standard D', which is shown as broken in Fig. 1; but such provisions are not always necessary. It is important to insulate very well the conductor C' in whatever manner it be supported.

The circuit or path just referred to forms also a part of a local circuit, which latter includes a relay magnet A and a battery a', the electromotive force of which is, as before explained, so determined that although the dielectric layers in the sensitive device A' are subjected to a great strain, yet normally they withstand the strain and no appreciable current flows through the local circuit; but when an electrical disturbance reaches the circuit the dielectric films are broken down, the resistance of the device A' is suddenly and greatly diminished, and a current traverses the relay magnet A.

The particular sensitive device employed consists of a metal cylinder, with insulating heads, through which passes a central metallic rod. A small quantity of grains of conducting material, such as an oxidized metal, is placed in the cylinder. A metallic strip, secured to an insulated post, bears against the side of the cylinder, connecting it with one part of the circuit. The central rod is connected to the frame of the instrument and so to the other part of the circuit. This instrument, which is similar in construction to the ordinary Branly coherer, differs from it only in the method used for restoring the particles to their original position after each impulse. Mr. Tesla uses for this purpose a spring device operated by the armature of an electromagnet. This is said to overcome all serious defects caused by the unequal size.

To do away with the defects in the sensitive device, Mr. Tesla makes the particles by a special tool, insuring their equality in size, weight and shape, and they are then uniformly oxidized by placing them for a given time in an acid solution. This secures

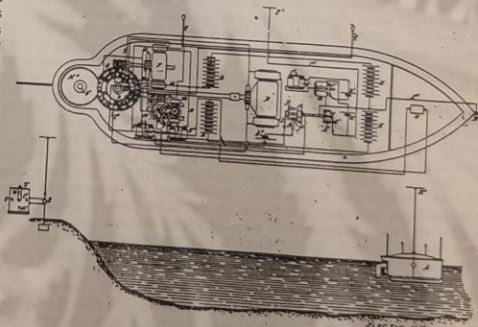
equal conductivity of their surfaces and stops their further deterioration, thus preventing a change in the character of the gas in the space in which they are enclosed. He prefers not to rarely the atmosphere within the sensitive device, as this has the effect of rendering the former less constant in regard to its dielectric properties, but merely secures an airtight inclosure of the particles and rigorous absence of moisture, which is fatal to satisfactory working.

The normal position of the cylinder c is vertical, and when turned in the manner described, the grains in it are simply shifted from one end to the other; but inasmuch as they always fall through the same space and are subjected to the same agitation they are brought after each operation of the relay to precisely the same electrical condition and offer the same resistance to the flow of the battery current until another impulse from afar reaches the receiving circuit.

Referring again to Fig. 2, K' K'' are two relay magnets conveniently placed in the rear of the propelling engine. One terminal of a battery k'' is connected to one end of each of the relay coils, the opposite terminal to the brush J', and the opposite ends of the relay coils to the brush J and to the frame of the instrument, respectively. As a consequence of this arrangement either the relay K' or K'' will be energized as the brush J' bears upon the plate j' or j'', respectively, or both relays will be inactive while the brush J' bears upon an insulating space between the plates j' and j''. While one relay, as K', is energized, its armature closes a circuit through the motor F, which is rotated in a direction to throw the rudder to port. On the other hand, when relay K'' is active another circuit through the motor F is closed, which reverses its direction of rotation and shifts the rudder to starboard. These circuits, however, are at the same time utilized for other obvious purposes.

Mr. Tesla informs a "Herald" reporter that using his special apparatus for the production of electrical waves and impulses, he will operate from his laboratory in New York a model which he will exhibit at the Paris Exposition in 1900; from which it may be inferred that he does not expect immediate practical utilization of the idea beyond that with which the New York public has already been made familiar by the electrical exhibition of last May.

The reporters who have been allowed to enter the laboratory state that Mr. Tesla has there a model roughly outlined of a torpedo boat on stocks, the keel of copper plate, with rudder and propeller in the usual positions, and showing two small incandescent lamps on standards. With this he illustrates the operation of the steering gear and of the lights by means of the



FIGS. 2 AND 3.

apparatus for projecting and receiving the electrical waves or impulses. No details are given by them of the mechanism.

Discussing the subject Prof. C. F. Brackett, of Princeton University, says: "The shortest, most correct and most complete criticism which I can make in reference to this bold boast is that what is new about it is useless, while that which is useful had all been discovered by other scientists long before Tesla made this startling announcement. You will find the whole theory which he has applied in any up-to-date text book. What Tesla has done is simply to make theoretical application, which would prove to be absolutely ridiculous in application of inventions.



which had already been discovered. There is nothing new about this. The theory is perfect, but the application absurd. So throughout Tesla's whole elaborate scheme, the theory is not at fault, although there is nothing original about it, but the circumstances under which its application would be necessitated are such that the only result would be failure. Do you suppose that in the din of battle it would be possible to put into execution those minute and carefully adjusted mechanical experiments, all of which are presupposed by his theory, which require the quiet of an uninterrupted laboratory to work successfully? Or do you think that the enemy would co-operate with the attack and place their vessels in exactly the correct position to be hit or that they would remain stationary while the torpedo boat approached? His theory would have to assume an affirmative answer in order to be a success, and moreover the torpedo boat would have to be seen from the base of operations in order to direct it. It would be discovered by the doomed vessel long before it reached its destination, and would be exploded on the spot, so how great an advance is this on the present mode of warfare?

Prof. A. E. Dolbear, of Tufts College, Massachusetts, says: "This last so-called invention of Nikola Tesla's is a very pretentious affair, and it is so incredible that the story is not to be believed until the work is actually done. If Tesla said all that the 'Herald' quotes him as saying, then his whole scheme and his manner of working is unintelligible to me. He even says that 'this power can be exerted at any distance by an agency of so delicate, so impalpable a quality, that I feel I am justified in predicting that the time will come when it can be called into action by the mere exercise of the human will.'"

"That is getting a little outside of science, but you will notice that Tesla himself is only predicting that this will come true. There has been no accomplishment. He proposes to do great things, but he does not tell how he is going to do them, and he hasn't done them himself yet."

"The announcement is most amazing, and, coming as it does from Tesla, scientists are all the more chary about accepting it. During the last six years he has made so many startling announcements and has performed so few of his promises that he is getting to be like the man who called 'Wolf! wolf!' until no one listened to him. Mr. Tesla has failed so often before that there is no call to believe these things until he really does them. Meantime, we are all waiting with much patience and without solicitude. We will believe them when they are done."

#### Regulations at the Paris Exposition.

THE entire space occupied by the Paris Exposition will be considered as a bonded warehouse, and foreign products forwarded to the exposition will enter France through all goods traffic offices. The sender will be required to forward a statement, which must be joined to the goods traffic receipt, and in which must be indicated the nature, kind, weight and origin of the products. All the shipments to the exposition will be subject to the conditions of international goods traffic or ordinary goods traffic, at the option of the parties interested. Shipments made by international or ordinary goods traffic will not undergo examination at the frontier of France. Sealing will be done free, and all shipments will be exonerated from statistic charges.

Foreign products received into the exposition grounds will be taken charge of by the special customs department of the exposition, and subject to the general rules of bonded warehouses. Any such products offered will not be taxed with more than a tariff applicable to similar products of the most favored nation. Objects manufactured within the limits of the exposition from materials of foreign origin imported under the customs régime will not be liable to any other duties than those pertaining to the manufactured materials.

The management of the exposition will take measures to protect against danger all objects exhibited. Exhibitors will be expected to insure their products at their own expense. On the other hand, the management will assume the responsibility for damage done to objects exhibited in the retrospective or centennial section, but only to the amount fixed by mutual agreement between the management and the exhibitors and entered on the certificate of admission. The management of the exposition will not assume any responsibility for thefts and robbery, but will organize a surveillance department to prevent robbery. Guards may be appointed by exhibitors, subject to the approval of the Director General's department. All guards or police will

be required to wear a uniform or distinctive emblem, and will obey all rules and regulations of the management of the exposition.

Exhibitors will have all the rights and immunities granted by the French law of May 23, 1868, as to the guarantee of inventions liable to be patented, and also of manufacturing designs, within the delays and subject to the conditions of said law. No exhibitor will be required to pay any rent for space occupied in any of the palaces, pavilions or buildings erected by the management of the exposition, and all water, gas, steam and motive power necessary for working all apparatus and machinery exhibited will be supplied free of charge. Exhibitors, however, will be required to furnish at their own expense the necessary piping for receiving water, gas or steam; also the intermediary transmissions required for the reception of the motive power on the driving shafts or belts.

Exhibitors will be required to pay all expenses connected with packing, shipping, unpacking, storage of cases, placing objects on exhibit, repacking and reshipping. No exhibitor will be allowed to erect a private building until the complete plans have been submitted to and approved by the management of the exposition, and all earth work and gardening done by exhibitors must be at their expense, and only upon the approval of the management. No exhibitor, concessionaire or other person will be allowed to advertise within the limits of the exposition by means of posters, prospectuses, hand bills, etc., without authority and permission from the Commissioner General.

All industrial products admitted to the exposition must be placed within the exposition in the period from December 1, 1899, and February 28, 1900.

#### Exports of Electrical Material from New York.

The following exports of electrical material are from the port of New York for the week ending Nov. 1:

Africa—13 packages electrical machinery, \$1,299. British Australia—32 packages electrical material, \$1,179. British Possessions in Africa—16 packages electrical machinery, \$7,450; 2 cases electrical material, \$213. Bremen—4 cases electrical material, \$255. Brazil—15 packages electrical machinery, \$12,722; 105 packages electrical material, \$3,242. Berlin—12 cases electrical material, \$300; 3 cases electrical machinery, \$893. Belfast—15 packages electrical machinery, \$1,704. Bristol—1 case electrical material, \$12. Central America—3 packages electrical material, \$2,850. Dutch West Indies—1 package electrical material, \$43. Florence—1 case electrical material, \$31. Genoa—3 cases electrical material, \$50. London—24 cases electrical material, \$1,005; 117 cases electrical material, \$6,065. Liverpool—5 packages electrical material, \$170. Vienna—3 cases electrical material, \$85.

#### The Louisville Experiments in Water Purification.

Data has recently been made public as to the various experiments for the purification of the water of the Ohio River at Louisville, Ky., where it is heavily charged with matter in suspension. Electrical methods were among those which were tried and are said to have failed. Discussing the report, the "Engineering News" sums up as follows: "Another confirmation of the opinions commonly held by disinterested scientists who have given the matter sufficient attention to warrant sound conclusions is that the direct treatment of water by electrical currents is of little value. There were, however, such apparently good grounds for hoping that a coagulant might be produced by electrolytic, in preference to chemical, methods, that extended studies of the subject were made. Nearly all of the so-called electrical systems of water and sewage purification, it may be stated here, are such only in the electrolytic production of a coagulant at the purification works, and for immediate use; instead of buying it from a manufacturing chemist. The Louisville experiments showed that the cost of the electrolytic production of aluminum hydrate was not only excessive, but that this method was unreliable 'on account of the very low and irregular formation of the hydrate.' An iron hydrate could be produced much more advantageously than an aluminum, and would be somewhat cheaper, apparently, than commercial sulphate of alumina, but it could not be safely employed at Louisville, because the water there at times is too low in dissolved oxygen to oxidize more iron than an equivalent of three grains of sulphate of alumina per gallon, which would be insufficient.



Tesla - Telautomata - Rival torpedoes

Letter to RUJ, Columbia College

46 E. Houston St. Feb. 28, 1900

My dear Luka,

...Have you seen in yesterday's Evening Post the reference to the "steering torpedoes"? I will keep low as I did in the Niagara episode, but I am sure the government will come to me.

Swezey card file  
S-4, frame 34



To Tesla from Richmond Pearson Hobson, 6 May 1902:

"I have brought the matter of your inventions in wireless transmission of electrical energy in connection with the naval exhibit at Buffalo to the attention of the Navy Department and you will get an official letter on the subject. . . . Do send something, if only plans, at once, that is before the opening of the 20th inst. . . . and follow same by the craft.

"Should you find it impossible to complete it in time, why could you not send the model I saw in your laboratory in '98 and your patent drawings and descriptions, even if you could send nothing else?

"Do not hesitate to write freely to the Chief Clerk, Mr. Peters . . . who is very cordial about the idea of including your patents in our exhibits. . . . I think this is a good opportunity for bringing your patents to the attention of the Navy without the usual difficulties of formalities. I think these patents have great value for our Navy and country and therefore my dear Tesla, do not fail in this matter of the first step toward their introduction.

"Now, take care of yourself, remember how much ~~of~~ your health means to the world, and to your friends and to your devoted friend R. P. Hobson."

---

Another letter, undated, refers to the above. Hobson tells Tesla there has been a fight within the Navy about Tesla's wireless exhibit being shown in the Navy Department Exhibit. Hobson says that it is the result of a feud not directly related to the invention but rather to something ongoing between two high officers. This has coincidentally resulted in the rejection of Tesla's craft. Presumably this is his remotely controlled boat.

(From Tesla Museum manuscripts collection)



# Electricity to Guide Torpedoes

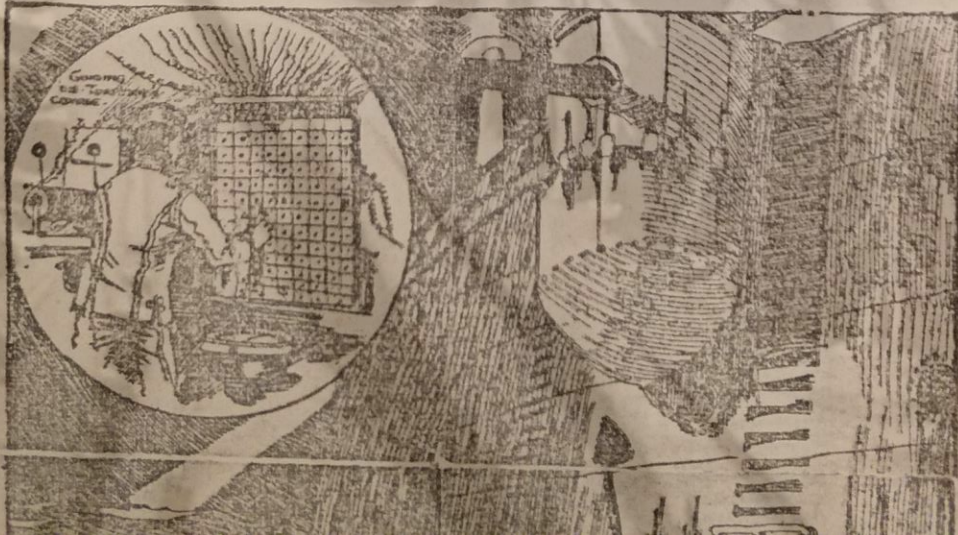
## Principle of Wireless Telegraphy to Make Engines of Destruction Certain in Their Work.

LONDON, Sept. 21.—(Special Correspondence of The Republican.)—At last a means has been discovered of guiding a torpedo on its mission of death. The principle of wireless telegraphy is to be applied to the steering of these submarine infernal machines, and, according to those who have examined the invention, this plan has been found to work so well that the torpedo may be reckoned among the heaviest thunderbolts of war, instead of being, as heretofore the jest of naval experts. A brief announcement of this important discovery has been cabled over, but a detailed description of the invention and the appearance of the torpedo as it appears when in action have been kept very secret.

The invention consists of an application of the electric waves just as in wireless telegraphy, obviating any necessity for metallic connection between the torpedo and the torpedo boat. To understand the plan of procedure it must be remembered that an iron rod is sucked into a coil of

ever way the escaping boat turns the torpedo will follow it as relentlessly as doom. Never was such diabolical intelligence given to an inanimate thing as the wireless telegraph principle will give to the torpedo of the future. What escape would there be for a ship followed by a shark who could by merely poking his nose against the side of the boat send the vessel with all aboard to the bottom? Guided by the electric waves that are controlled by the crew of the torpedo boat, the new torpedo will be just as impossible to shake off as the living fish.

This seems to have solved the great puzzle that has made torpedos as much of a menace to those who fired them as to those against whom they were directed. The history of torpedo warfare has always tended to place the supposedly terrible missile in a ridiculous light. Here and there are recorded instances of the torpedo taking effect and sinking a vessel, but for every torpedo that has fulfilled its mission hundreds have been left to





LONDON, Sept. 21.—(Special Correspondence of The Republic.)—At last a means has been discovered of guiding a torpedo on its mission of death. The principle of wireless telegraphy is to be applied to the steering of these submarine internal machines, and, according to those who have examined the invention, this plan has been found to work so well that the torpedo may be reckoned among the heaviest thunderbolts of war, instead of being, as heretofore the jest of naval experts. A brief announcement of this important discovery has been cabled over, but a detailed description of the invention and the appearance of the torpedo as it appears when in action have been kept very secret.

The invention consists of an application of the electric waves just as in wireless telegraphy, obviating any necessity for metallic connection between the torpedo and the torpedo boat. To understand the plan of procedure it must be remembered that an iron rod is sucked into a coil of

ever way the escaping boat turns the torpedo will follow it as relentlessly as doom. Never was such diabolical intelligence given to an inanimate thing as the wireless telegraph principle will give to the torpedo of the future. What escape would there be for a ship followed by a shark who could by merely poking his nose against the side of the boat send the vessel with all aboard to the bottom? Guided by the electric waves that are controlled by the crew of the torpedo boat, the new torpedo will be just as impossible to shake off as the living fish.

This seems to have solved the great puzzle that has made torpedos as much of a menace to those who fired them as to those against whom they were directed. The history of torpedo warfare has always tended to place the supposedly terrible missile in a ridiculous light. Here and there are recorded instances of the torpedo taking effect and sinking a vessel, but for every torpedo that has fulfilled its mission hundreds have been left to

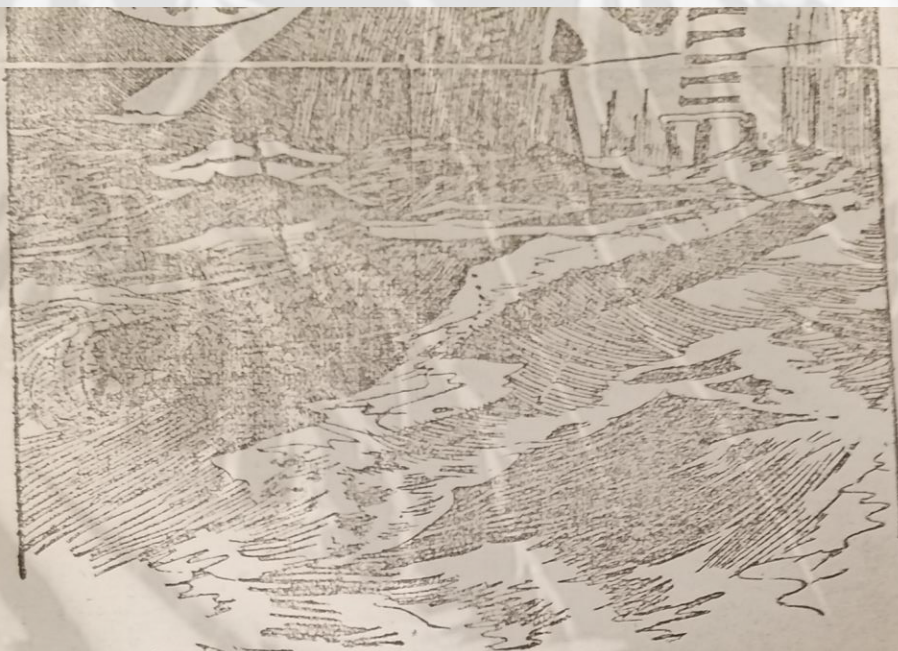


GUIDING A TORPEDO BY ELECTRICAL WAVES.

wire, when an electric current traverses the spiral in a suitable direction. The torpedo is provided with two staffs which project above the surface of the water and can receive electric waves reaching them through the air, and generated by an apparatus on the torpedo boat. To the rudder apparatus on the torpedo boat. To the head of the torpedo are attached

rust at the bottom of the sea while hundreds more have exploded harmlessly and killed only the fishes that were unlucky enough to be in the vicinity. This helplessness of the torpedo has been the main cause of the lack of respect naval officers have felt for it. The searchlight has





GUIDING A TORPEDO BY ELECTRICAL WAVES.

wire, when an electric current traverses the spiral in a suitable direction. The torpedo is provided with two staffs which project above the surface of the water and can receive electric waves reaching them through the air, and generated by an apparatus on the torpedo boat. To the rudder head of the torpedo are attached two coils of wire with two cores of iron near them. When an electric current passes round the coils in one direction, one of the cores is sucked in, while if the current circulates in the other direction the other core enters its spiral. Suppose the torpedo leaves its proper course. It is at once righted in the following way. Electric waves are developed on the torpedo boat, pass through the air, and are received by the staffs attached to the torpedo. These by a simple apparatus are made to develop an electric current in the coils of wire, and one or the other of the iron cores, as occasion requires, is sucked into its coil, and this movement turns the helm of the torpedo. When the torpedo has reached its proper course the waves from the controller are stopped. The invention will render it possible to cause a torpedo to move in any direction almost as if it were possessed of a separate intelligence.

#### Will Follow Its Victim.

That statement is not an exaggeration. The torpedo of the future will actually be made to follow the direction of the ship it seeks to fasten to and destroy. If the torpedo is seen by those aboard this ship and a frantic effort is made to escape the direct line of discharge it will be useless, for the nose of the torpedo will be immediately turned by those aboard the torpedo boat in the new direction taken by the hostile ship, and after that, which

rust at the bottom of the sea while hundreds more have exploded harmlessly and killed only the fishes that were unlucky enough to be in the vicinity. This helplessness of the torpedo has been the main cause of the lack of respect naval officers have felt for it. The searchlight has made it so risky to attack a vessel with a torpedo at night that only a very reckless commander would attempt it, while the various devices for guarding a ship's side against torpedos have made these missiles almost certain to fail in their object. Then again it was easy to dodge a torpedo when its direction once became apparent.

#### Makes Results Certain.

Now all this is changed. When the torpedo is fired from a vessel's side it drops into the water at a distance of fifteen feet, dives about twenty feet, and then shoots up and goes through the water like a fish for a distance of about half a mile, which distance it covers in about a minute. It is a costly missile and the British naval officers have always thought it of doubtful effectiveness in warfare. With the "Whitehead" guided by electric waves, however, it is realized that the torpedo takes on a new and formidable aspect that places it in an entirely new category among weapons of war.

Whether or not the same principle that directs the torpedo from the vessel that launches it could be used by those on board the threatened ship to turn it back on those who fired it, is another interesting problem that presents itself at the beginning of speculative thinking on this subject. It is almost certain that some method of defence will be found by ingenious minds against the newly-found means of blowing up ships.



N. Y. Sun, Nov. 8, 1898, p 7, col 1,2

Tesla's New War Wonder

Has Model of Ship Operated by Magnetic Waves from Shore

"Nikola Tesla, whose original discoveries in electrical science during the past ten years have placed him in the foremost ranks of science, and whose application of his discoveries have made him recognized as one of the world's greatest inventors, makes public today his latest discovery and invention, which he believes is also his greatest one. In brief, Mr. Tesla believes that this invention will not only answer many useful purposes in ordinary life, but that it would make war so terrible as well as expensive, as to make it prohibitory, and thus to assure peace between all the nations.."

"The idea of the invention came to Mr. Tesla years ago, and he has never lost sight of it since, but it was not until the war with Spain came and stirred him with patriotism -- for Mr. Tesla is American to the backbone - that the scheme took definite form and shape. Then the idea completely possessed him and gave him no rest until the problem was worked out in its entirety."

In lab at E. Houston St., Tesla has working model of vessel.

S-5, frame 35



Tesla - Telautomata - Rival torpedoes

Letter to RUJ, Columbia College

46 E. Houston St. Feb. 28, 1900

My dear Luka,

...Have you seen in yesterday's Evening Post the reference to the "steering torpedoes"? I will keep low as I did in the Niagara episode, but I am sure the government will come to me.

Swezey card file  
S-4, frame 34



TELAUTOMATON

Letter from Tesla to Sam. Cohen TM

Samuel Cohen,  
Experimenter Publ Co.  
233 Fulton St.  
Mar. 19, 1916

".. sending photos of two of my wireless boats of which smaller one was illustrated in my article in Century. Constructed in '97 and '98. This was long before issue of my patent. In fact, I acquainted a great number of friends with principles of 'telautomatics' in experiments from '92 to '95.

"In smaller machines all apparatus was condensed in space of about 3 feet and it was designed specifically to perform innumerable operations with great precision. Patent does not show full perfection of control because at that time I had not obtained patents on individualizing methods, but I had embodied principles (of these methods) in my telautomaton. Usually, when exhibited, visitors would ask questions they liked and the machine would answer by signs, such as shifting rudder or rotating propeller, or lighting lights, exploding cartridges, firing revolvers, etc. At that period I also designed automobile automaton with several novel features.

see: Electrical Review (NY) Nov. 9, 16, and dec 7, 1898

from Swezey card file  
S-3



TELAUTOMATON

N. Y. Sun, Nov. 8, 1898, p 7, col 1,2

Tesla's New War Wonder

Has Model of Ship Operated by Magnetic Waves from Shore

"Nikola Tesla, whose original discoveries in electrical science during the past ten years have placed him in the foremost ranks of science, and whose application of his discoveries have made him recognized as one of the world's greatest inventors, makes public today his latest discovery and invention, which he believes is also his greatest one. In brief, Mr. Tesla believes that this invention will not only answer many useful purposes in ordinary life, but that it would make war so terrible as well as expensive, as to make it prohibitory, and thus to assure peace between all the nations.."

"The idea of the invention came to Mr. Tesla years ago, and he has never lost sight of it since, but it was not until the war with Spain came and stirred him with patriotism -- for Mr. Tesla is American to the backbone - that the scheme took definite form and shape. Then the idea completely possessed him and gave him no rest until the problem was worked out in its entirety."

In lab at E. Houston St., Tesla has working model of vessel.

S-5, frame 35



TELEAUTOMATON

Phila. Press May 1, 1898

(Interview concerning device for telegraph to warships 100 miles away)

Nikola Tesla's Revolution in War Telegraphy

Interviewed concerning ideas on war with Spain:

"One reason I cannot tell you just what my machine is, is that if it can be used on our ships it will give us an advantage; and I shall be proud to have been of so much use to my country."

"Then you consider yourself a good American?"

The inventor threw up his hands and looked incredulous at the suggestion of doubt.

"I a good American?" he said, "I was a good American before I ever saw this country. I had studied its government; I had met some of its people, I admired America. I was at heart an American before I thought of coming here to live."

"What opportunities this country offers a man! Its people are a thousand years ahead of the people of any other nation of the world. They are big, broadminded, generous. I could not have accomplished in any other country what I have here."

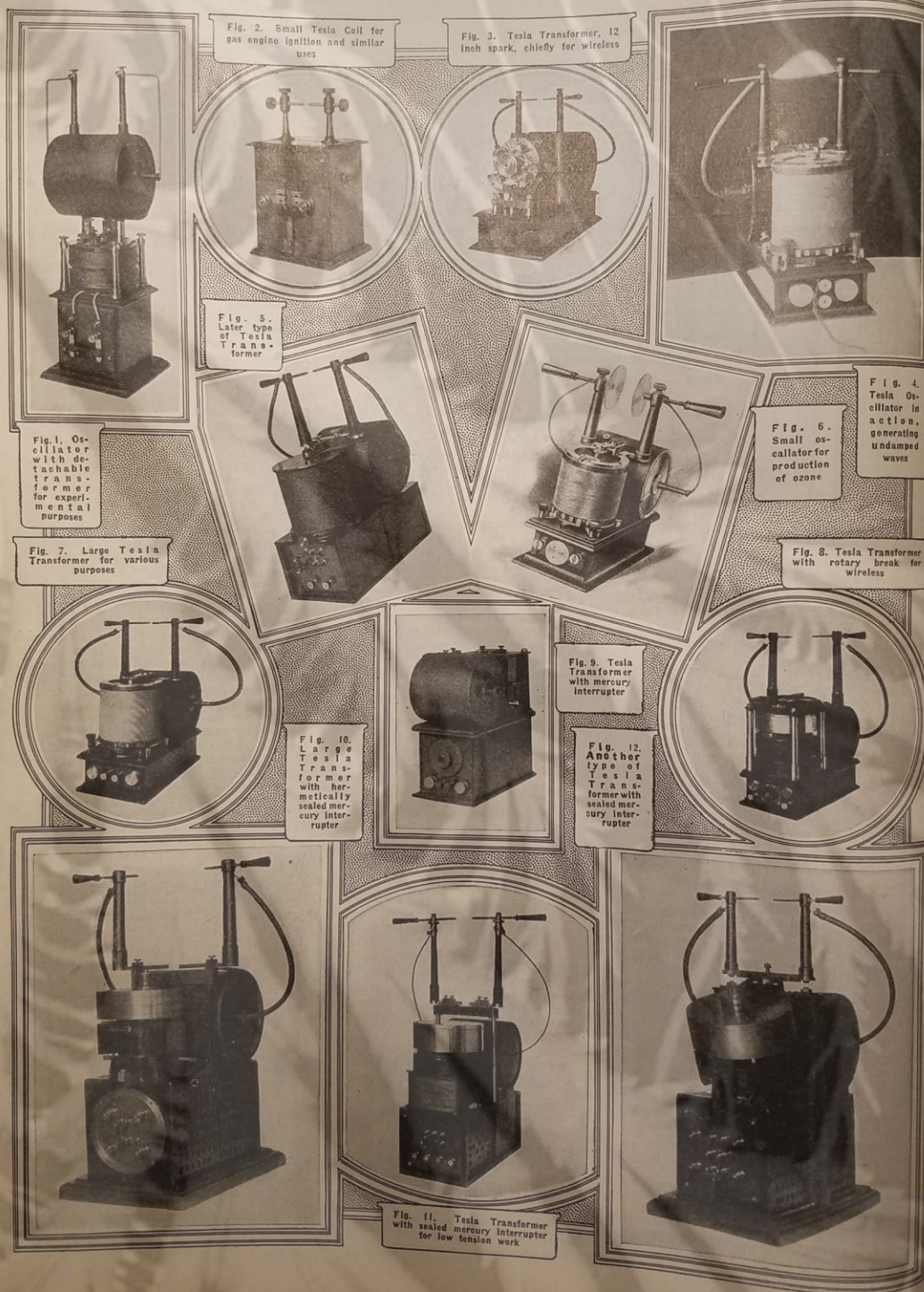
"...The American people are quick to hold out a helping hand and to give recognition. Yes I am as good an American as there is. I have nothing to sell the government of the U. S. If it needs my service in any way it is welcome to them."

From Svezey card file  
S-3

DUPLICATE



# Electrical Oscillators



ph  
con

Fig.  
Co

men  
tion  
mer  
nize  
fect  
publ  
hunn  
the  
tain  
Yet,  
the  
in st  
Fi  
sity  
a ra  
eigh  
nour  
type  
oscil  
and  
not  
today  
consi

Fig  
trat



# Electrical Oscillators

By NIKOLA TESLA

**F**EW fields have been opened up the exploration of which has proved as fruitful as that of high frequency currents. Their singular properties and the spectacular character of the phenomena they presented immediately commanded universal attention. Scientific



Fig. 13—Tesla Oscillator with Magnetically Controlled, Sealed Mercury Interrupter.

men became interested in their investigation, engineers were attracted by their commercial possibilities, and physicians recognized in them a long-sought means for effective treatment of bodily ills. Since the publication of my first researches in 1891, hundreds of volumes have been written on the subject and many invaluable results obtained thru the medium of this new agency. Yet, the art is only in its infancy and the future has incomparably bigger things in store.

From the very beginning I felt the necessity of producing efficient apparatus to meet a rapidly growing demand and during the eight years succeeding my original announcements I developed not less than fifty types of these transformers or electrical oscillators, each complete in every detail and refined to such a degree that I could not materially improve any one of them today. Had I been guided by practical considerations I might have built up an im-

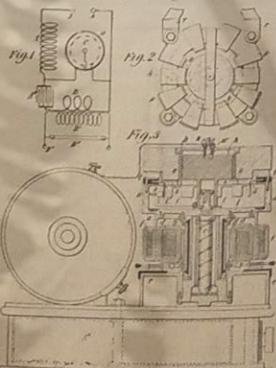


Fig. 14—Electrical Oscillator, Illustrated in Fig. 13, Showing Details and Circuit Connections.

**MR. TESLA** makes a very important contribution to the electrical arts with this article.

The pioneer of all high frequency apparatus divulges much that is new and startling in these pages. Few people realize the enormous value of Mr. Tesla's machines and the many different important uses to which they can be applied in our everyday lives. New and startling uses are being found every year for these machines.

It is characteristic of Mr. Tesla that he has developed and actually built an astounding variation of these machines, and we regret that we can publish only a very few of the more important models.

Most of the Tesla coils shown have never been published before. —EDITOR.

mense and profitable business, incidentally rendering important services to the world. But the force of circumstances and the ever enlarging vista of greater achievements turned my efforts in other directions. And so it comes that instruments will shortly be placed on the market which, oddly enough, were perfected twenty years ago!

These oscillators are expressly intended to operate on direct and alternating lighting circuits and to generate damped and undamped oscillations or currents of any frequency, volume and tension within the widest limits. They are compact, self-contained, require no care for long periods of time and will be found very convenient and useful for various purposes as, wireless telegraphy and telephony; conversion of electrical energy; formation of chemical compounds thru fusion and combination; synthesis of gases; manufacture of ozone; lighting; welding; municipal, hospital, and domestic sanitation and sterilization, and numerous other applications in scientific laboratories and industrial institutions. While these transformers have never been described before, the general principles underlying them were fully set forth in my published articles and patents, more par-

ticularly those of September 22, 1896, and it is thought, therefore, that the appended photographs of a few types, together with a short explanation, will convey all the information that may be desired.

The essential parts of such an oscillator are: a condenser, a self-induction coil for

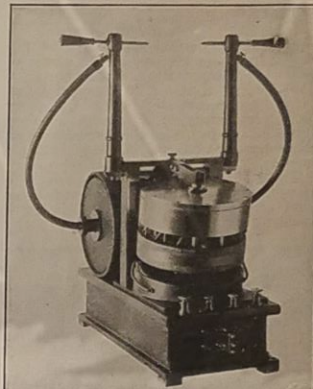


Fig. 15—Tesla Transformer with Gravity Controlled, Sealed Mercury Interrupter.

charging the same to a high potential, a circuit controller, and a transformer which is energized by the oscillatory discharges of the condenser. There are at least three, but usually four, five or six, circuits in tune and the regulation is effected in several ways, most frequently merely by means of an adjusting screw. Under favorable conditions an efficiency as high as 85% is attainable, that is to say, that percentage of the energy supplied can be recovered in the secondary of the transformer. While the chief virtue of this kind of apparatus is obviously due to the wonderful powers of the condenser, special qualities result from concatenation of circuits under observance of accurate harmonic relations, and minimization of frictional and other losses which has been one of the principal objects of the design.

(Continued on page 259)

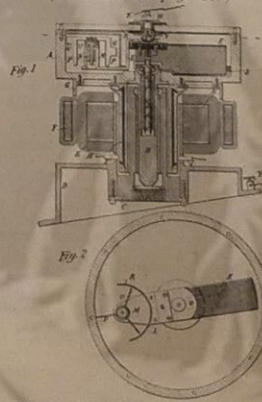


Fig. 16—Electrical Oscillator, Illustrated in Fig. 15, Showing Details of Motor and Break Mechanism.

## SPECIAL NOTICE

Last month we announced another special feature article by Mr. Tesla, which although made in good faith by us was not authorized by him. Due to very important duties of Mr. Tesla, it was impossible for him to furnish his historical article this month, so the special feature article published on this page takes its place. An important historical article will appear in the August issue.—Editor.



Patent Service  
of the U. S. Patent Office  
**MAN T. WHITAKER**  
Lawyer and Engineer  
1001 Bldg.  
Washington, D. C.  
Inquiries Invited

County Agents Wanted  
For Our Line of  
**ELECTRIC FARM  
LIGHTING PLANTS**  
Good money made  
selling these plants  
throughout the country.  
We also sell a line of  
batteries, lanterns, etc.  
**ELECTRIC COMPANY**  
Chicago, Ill.

Get up-to-date in the  
latest in the  
line of  
batteries, lanterns, etc.  
We also sell a line of  
batteries, lanterns, etc.  
**ELECTRIC COMPANY**  
Chicago, Ill.

and D. C.  
**K FAN**  
ft. of cord,  
60 current,  
steel dial,  
fan-not a  
warrant.

"Geyser"  
Water Heater  
MFG. CO.  
New York City

WAY TO PAINT  
**HOW CARDS**  
DO THE WORK  
We can paint all kinds of  
any surface with our  
Complete outfit consisting  
of four sets of brushes, etc.  
at our own price, and  
over again for your  
instructions. \$7.50  
1000  
Bldg., Denver, Colo.

**MACHINE 1**  
We have made  
of metal and  
polished. The  
level pocket  
or home machine  
today. The 1000  
not to forget to do  
it.

DO NOT  
ME TRUET  
FULLY  
POWER  
QUALITY  
When choosing  
KNOWS and your  
to.

**MONEY**  
We pay \$50  
more for your  
Cubans, N. Y.

July, 1919

## Electrical Oscillators

By Nikola Tesla

(Continued from page 229)

Broadly, the instruments can be divided into two classes: one in which the circuit controller comprises solid contacts, and the other in which the make and break is effected by mercury. Figures 1 to 8, inclusive, belong to the first, and the remaining ones to the second class. The former are capable of an appreciably higher efficiency on account of the fact that the losses involved in the make and break are reduced to the minimum and the resistance component of the damping factor is very small. The latter are preferable for purposes requiring larger output and a great number of breaks per second. The operation of the motor and circuit controller of course consumes a certain amount of energy which, however, is the less significant the larger the capacity of the machine.

In Fig. 1 is shown one of the earliest forms of oscillator constructed for experimental purposes. The condenser is contained in a square box of mahogany upon which is mounted the self-induction or charging coil wound, as will be noted, in two sections connected in multiple or series according to whether the tension of the supply circuit is 110 or 220 volts. From the box protrude four brass columns carrying a plate with the spring contacts and adjusting screws as well as two massive terminals for the reception of the primary of the transformer. Two of the columns serve as condenser connections while the other pair is employed to join the binding posts of the switch in front to the self-inductance and condenser. The primary coil consists of a few turns of copper ribbon to the ends of which are soldered short rods fitting into the terminals referred to. The secondary is made in two parts, wound in a manner to reduce as much as possible the distributed capacity and at the same time enable the coil to withstand a very high pressure between its terminals at the center, which are connected to binding posts on two rubber columns projecting from the primary. The circuit connections may be slightly varied but ordinarily they are as diagrammatically illustrated in the ELECTRICAL EXPERIMENTER for May on page 89, relating to my oscillation transformer photograph of which appeared on page 16 of the same number. The operation is as follows: When the switch is thrown on, the current from the supply circuit rushes thru the self-induction coil, magnetizing the iron core within and separating the contacts of the controller. The high tension induced current then charges the condenser and upon closure of the contacts the accumulated energy is released thru the primary, giving rise to a long series of oscillations which excite the tuned secondary circuit.

This device has proved highly serviceable in carrying on laboratory experiments of all kinds. For instance, in studying phenomena of impedance, the transformer was removed and a bent copper bar inserted in the terminals. The latter was often replaced by a large circular loop to exhibit inductive effects at a distance or to excite resonant circuits used in various investigations and measurements. A transformer suitable for any desired performance could be readily improvised and attached to the terminals and in this way much time and labor was saved. Contrary to what might be naturally expected, little trouble was experienced with the contacts, altho the currents thru them were heavy, namely, proper conditions of resonance existing, the great flow occurs only when the circuit is closed and no destructive arcs can develop. Orig-

## ELECTRICAL EXPERIMENTER

259

## Starrett Tools

have gaged the accuracy of the world's work for thirty-nine years.

Manufacturers, toolmakers, machinists and mechanics in all trades, rely upon this precision.

Illustrated catalog No. 21LE sent free upon request.

**The L. S. Starrett Co.**

The World's Greatest Toolmakers

Manufacturers of Hack Saws Unexcelled

Athol, Mass. 42-940



## YOUR OPPORTUNITY

### Canceled Government Contracts

We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.

This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture



Battery Charging Outfit

For use on 110 volt. A. C. 60 cycle, single phase current only.  
80 watts, 6 volts, 10 amperes. \$48.50  
150 watts, 10 volts, 10 amperes. \$68.50  
180 watts, 15 volts, 10 amperes. \$68.50  
300 watts, 30 volts, 10 amperes. \$94.50  
All outfits complete with switch-board as cut shown.



Mail \$5.00 cash or Money Order. We will send C. O. D. subject to full examination. MONEY BACK GUARANTEE



Mail \$5.00 cash or Money Order. We will send C. O. D. subject to full examination. MONEY BACK GUARANTEE

**1 1/2 H.P. INDUCTION MOTOR**  
110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M.

ALL MOTORS COMPLETE AS CUT

**1/4 H.P. 110 volts**  
A. C. 60 cycle, single phase, 1750 R. P. M.

WASHING MACHINE MOTOR

**\$18.50**

WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES

**230 POLYPHASE MOTORS** 1750 RPM. 60 cycle, 3 or 4 phase. Complete, fully equipped. 1 H. P. \$159.50 3 H. P. \$244.50 5 H. P. \$312.50


**NEW MOTORS** 110-220 volts. 60 cycle, single phase. Complete with pulley. 1/2 Hp. \$44.50 1 Hp. \$67.50

MANUFACTURERS' DISTRIBUTOR

CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.





**Health, Strength, Vitality**  
**Personal Appearance—All Demand**

The **STERLING HIGH FREQUENCY VIOLET RAY**

Specially designed for home use—fitted to work from the ordinary lamp socket—easy to manipulate under control at all times—and contains within its covers the Services of a servant, a doctor of medicine and a nerve and beauty specialist—all in one, ready for instant service.

The Sterling Violet Ray is invaluable in the treatment of diseases of the skin, mouth, throat and lungs, derangements of the liver, kidneys, stomach and intestines—soreness in muscles and joints—tired or "sick" brains or lack of "nerve tone." It strengthens heart action—cleanses the blood—brings the flush of youth to the skin—enlivens the hair—puts a "spring in your step" and creates a clear eye and brain.

Sterling Violet Ray Generators are based upon the original discoveries of Nikola Tesla, but have been developed to the highest state of perfection ever reached by Mr. Anthony Longoria, whose long years of practical experience entitle him to the commanding position he holds.

**VALUABLE BOOK FREE**

We want to send you our book and full particulars about the Sterling Violet Ray Machines. Read how you can treat innumerable diseases and ailments, improve your personal charm, add strength and vitality and help yourself in hundreds of ways. Just mail the coupon or drop a postal. Do it now, this minute, before you forget it.

**The STERLING ELECTRICAL CORPORATION**  
1278 West 3rd St. Cleveland, Ohio

**MAIL THIS COUPON**

**THE STERLING ELECTRICAL CORPORATION**  
1278 West 3rd Street  
Cleveland, Ohio

Gentlemen:—As per your offer in Electrical Experimenter, please mail me at once, free and postpaid, your book and full information about the Sterling Violet Ray Generators.

NAME .....

ADDRESS .....

CITY ..... STATE .....

**FOR FREE BOOK.**

nally I employed platinum and iridium tips but later replaced them by some of meteorite and finally of tungsten. The last have given the best satisfaction, permitting working for hours and days without interruption.

Fig. 2 illustrates a small oscillator designed for certain specific uses. The underlying idea was to attain great activities during minute intervals of time each succeeded by a comparatively long period of inaction. With this object a large self-induction and a quick-acting break were employed owing to which arrangement the condenser was charged to a very high potential. Sudden secondary currents and sparks of great volume were thus obtained, eminently suitable for welding thin wires, flashing lamp filaments, igniting explosive mixtures and kindred applications. The instrument was also adapted for battery use and in this form was a very effective igniter for gas engines on which a patent bearing number 609,250 was granted to me August 16, 1898.

Fig. 3 represents a large oscillator of the first class intended for wireless experiments, production of Röntgen rays and scientific research in general. It comprises a box containing two condensers of the same capacity on which are supported the charging coil and transformer. The automatic circuit controller, hand switch and connecting posts are mounted on the front plate of the inductance spool as is also one of the contact springs. The condenser box is equipped with three terminals, the two external ones serving merely for connection while the middle one carries a contact bar with a screw for regulating the interval during which the circuit is closed. The vibrating spring itself, the sole function of which is to cause periodic interruptions, can be adjusted in its strength as well as distance from the iron core in the center of the charging coil by four screws visible on the top plate so that any desired conditions of mechanical control might be secured. The primary coil of the transformer is of copper sheet and taps are made at suitable points for the purpose of varying, at will, the number of turns. As in Fig. 1 the inductance coil is wound in two sections to adapt the instrument both to 110 and 220 volt circuits and several secondaries were provided to suit the various wave lengths of the primary. The output was approximately 500 watt with damped waves of about 50,000 cycles per second. For short periods of time undamped oscillations were produced in screwing the vibrating spring tight against the iron core and separating the contacts by the adjusting screw which also performed the function of a key. With this oscillator I made a number of important observations and it was one of the machines exhibited at a lecture before the New York Academy of Sciences in 1897.

Fig. 4 is a photograph of a type of transformer in every respect similar to the one illustrated in the May, 1919, issue of the ELECTRICAL EXPERIMENTER to which reference has already been made. It contains the identical essential parts, disposed in like manner, but was specially designed for use on supply circuits of higher tension, from 220 to 500 volts or more. The usual adjustments are made in setting the contact spring and shifting the iron core within the inductance coil up and down by means of two screws. In order to prevent injury thru a short-circuit, fuses are inserted in the lines. The instrument was photographed in action, generating undamped oscillations from a 220 volt lighting circuit.

Fig. 5 shows a later form of transformer principally intended to replace Rhumkorf coils. In this instance a primary is employed, having a much greater number of turns and the secondary is closely linked with the same. The currents developed in the latter, having a tension of from 10,000 to 30,000 volts, are used to charge condenser.

(Continued on page 276)

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

**FREE!**

YES, a \$15 Complete Working Outfit with instruments, drawing board, etc., and a drawing table absolutely free. It does not cost a penny.

**Draw \$150 to \$300 a Month**

Companies are calling for men to fill positions paying from \$150 to \$300 a month. We will give you just the training required to hold one of these jobs—right in your own home. I am Chief Draftsman of a large and well known company.

**Write Today** For my free book on drafting and my latest "Personal Instruction" offer to a few students. A post card or letter will do. No obligation.

**Chief Draftsman Dobe** Engineers Equipment Co. Div. 8744 Chicago, Ill.

## Send Only 12c

(Stamps or Coin)

And I will send you a copy of my valuable booklet.

### "Hints to Music Loving Owners of Talking Machines"

Tells you how to take care of your machine and records, preserve the life of both, and gives many pointers to improve the tone of your instrument and increase the enjoyment of it. Instructs on the care of the motor, cleaning, speed adjustment, care of the needles—in fact every thing you should know. Send 12c today and the booklet will come by return mail.

**J. H. ELLIS, Box 882, Milwaukee, Wis.**  
Patentee & Manufacturer, Ellis Harmonious Reproducer

## Build Your Own PHONOGRAPH.

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your needs. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make the profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Phonographs.

**Choraleon Phonograph Co.**  
707 Manger Bldg., Elkhart, Ind.

**FREE \$20**

Violin, Hawaiian Guitar, Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching notes music by mail. To first pupils in each locality, we'll give a \$20 superior Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.

**SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.**

**FREE! Sonora**

These phonograph needles Semi-Permanent Silver replace steel needles, play 50 to 100 times and are used on ALL MAKES of steel needle records. Economical, convenient, improve tone, and preserve records. 30c per card of 5. 40c in Canada. Write today for FREE sample.

**Sonora Phonograph Sales Company, Inc.**  
GEORGE E. BRIGHTON, President  
279 Broadway, Dept. G, New York Toronto: Ryrie Bldg.

**BUILD A \$100 PHONOGRAPH**

Assemble your own Phonograph Do it yourself easily. Have the finest machine. Astonishing saving. We give you the phonograph secrets. Complete instructions 10 cents.

**ELECTRO MECHANICAL PARTS CO.**  
160 N. Wells St. CHICAGO

**MULTIPLYING SIMPLIFIED**

By our Tabulated Multiplication Card! This is something which you do not think of until you need it. Its merit lies in its handiness. Pocket size card 2 1/2 x 6 ins. Send for Payment with order. Price only 10 cents (coin).

**TABULATED INFORMATION CARD CO.**  
2046 Chestnut St. Philadelphia, Pa.

**STAMMERER**

Send 10 cents for my remarkable book "How To Stop Stammering." Kill the fear of stammering. No education, the key.

**The Hatfield Institute, 100 N. Dearborn St., Chicago, Ill.**



## Electrical Oscillators

By Nikola Tesla

(Continued from page 260)

densers and operate an independent high frequency coil as customary. The controlling mechanism is of somewhat different construction but the core and contact spring are both adjustable as before.

Fig. 6 is a small instrument of this type, particularly intended for ozone production or sterilization. It is remarkably efficient for its size and can be connected either to a 110 or 220 volt circuit, direct or alternating, preferably the former.

In Fig. 7 is shown a photograph of a



Fig. 17. Tesla Transformer With Adjustable Mercury Controller.

larger transformer of this kind. The construction and disposition of the parts is as before but there are two condensers in the box, one of which is connected in the circuit as in the previous cases, while the other is in shunt to the primary coil. In this manner currents of great volume are produced in the latter and the secondary effects are accordingly magnified. The introduction of an additional tuned circuit secures also other advantages but the adjustments are rendered more difficult and for this reason it is desirable to use such an instrument in the production of currents of a definite and unchanging frequency.

Fig. 8 illustrates a transformer with rotary break. There are two condensers of the same capacity in the box which can be connected in series or multiple. The charging inductances are in the form of two long spools upon which are supported the secondary terminals. A small direct current motor, the speed of which can be varied within wide limits, is employed to drive a specially constructed make and break. In other features the oscillator is like the one illustrated in Fig. 3 and its operation will be readily understood from the foregoing. This transformer was used in my wireless experiments and frequently also for lighting the laboratory by my vacuum tubes and was likewise exhibited at my lecture before the New York Academy of Sciences above mentioned.

Coming now to machines of the second class, Fig. 9 shows an oscillatory transformer comprising a condenser and charging inductance enclosed in a box, a transformer and a mercury circuit controller, the latter being of a construction described for the first time in my patent No. 609,251 of August 16, 1898. It consists of a motor driven hollow pulley containing a small quantity of mercury which is thrown outwardly against the walls of the vessel by

centrifugal force and entrains a contact wheel which periodically closes and opens the condenser circuit. By means of adjusting screws above the pulley, the depth of immersion of the vanes and consequently, also, the duration of each contact can be varied at desire and thus the intensity of the effects and their character controlled. This form of break has given thorough satisfaction, working continuously with currents of from 20 to 25 amperes. The number of interruptions is usually from 500 to 1,000 per second but higher frequencies are practicable. The space occupied is about 10" x 8" x 10" and the output approximately  $\frac{1}{2}$  K.W.

In the transformer just described the break is exposed to the atmosphere and a slow oxidation of the mercury takes place. This disadvantage is overcome in the instrument shown in Fig. 10, which consists of a perforated metal box containing the condenser and charging inductance and carrying on the top a motor driving the break, and a transformer. The mercury break is of a kind to be described and operates on the principle of a jet which establishes, intermittently, contact with a rotating wheel in the interior of the pulley. The stationary parts are supported in the vessel on a bar passing thru the long hollow shaft of the motor and a mercury seal is employed to effect hermetic closure of the chamber enclosing the circuit controller. The current is led into the interior of the pulley thru two sliding rings on the top which are in series with the condenser and primary. The exclusion of the oxygen is a decided improvement, the deterioration of the metal and attendant trouble being eliminated and perfect working conditions continuously maintained.

Fig. 11 is a photograph of a similar oscillator with hermetically inclosed mercury break. In this machine the stationary parts of the interrupter in the interior of the pulley were supported on a tube thru which was led an insulated wire connecting to one terminal of the break while the other was in contact with the vessel. The sliding rings were, in this manner, avoided and the construction simplified. The instrument was designed for oscillations of lower tension and frequency requiring primary currents of comparatively smaller amperage and was used to excite other resonant circuits.

Fig. 12 shows an improved form of oscillator of the kind described in Fig. 10, in which the supporting bar thru the hollow motor shaft was done away with, the device pumping the mercury being kept in position by gravity, as will be more fully explained with reference to another figure. Both the capacity of the condenser and primary turns were made variable with the view of producing oscillations of several frequencies.

Fig. 13 is a photographic view of another form of oscillatory transformer with hermetically sealed mercury interrupter, and Fig. 14 diagrams showing the circuit connections and arrangement of parts reproduced from my patent, No. 609,245, of August 16, 1898, describing this particular device. The condenser, inductance, transformer and circuit controller are disposed as before, but the latter is of different construction, which will be clear from an inspection of Fig. 14. The hollow pulley *a* is secured to a shaft *c* which is mounted in a vertical bearing passing thru the stationary field magnet *d* of the motor. In the interior of the vessel is supported, on frictionless bearings, a body *h* of magnetic material which is surrounded by a dome *b* in the center of a laminated iron ring, with pole pieces *oo* wound with energizing coils

*p*. The ring is supported on four columns and, when magnetized, keeps the body *h* in position while the pulley is rotated. The latter is of steel, but the dome is preferably made of German silver burnt black by acid or nickel. The body *h* carries a short tube *k* bent, as indicated, to catch the fluid as it is whirled around, and project it against the teeth of a wheel fastened to the pulley. This wheel is insulated and contact from it to the external circuit is established thru a mercury cup. As the pulley is rapidly rotated a jet of the fluid is thrown against the wheel, thus making and break-

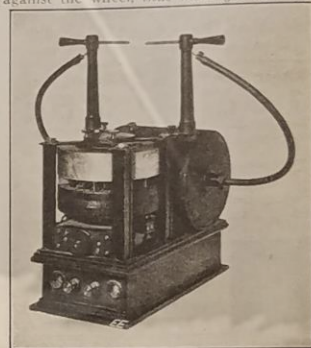


Fig. 18. Tesla Transformer With Mercury Jet Interrupter.

ing contact about 1,000 times per second. The instrument works silently and, owing to the absence of all deteriorating agents, keeps continually clean and in perfect condition. The number of interruptions per second may be much greater, however, so as to make the currents suitable for wireless telephony and like purposes.

A modified form of oscillator is represented in Figs. 15 and 16, the former being a photographic view and the latter a diagrammatic illustration showing the arrangement of the interior parts of the controller. In this instance the shaft *b* carrying the vessel *a* is hollow and supports, in frictionless bearings, a spindle *j* to which is fastened a weight *k*. Insulated from the latter, but mechanically fixed to it, is a curved arm *L* upon which is supported, freely rotatable, a break-wheel with projections *QQ*. The wheel is in electrical connection with the external circuit thru a mercury cup and an insulated plug supported from the top of the pulley. Owing to the inclined position of the motor the weight *k* keeps the break-wheel in place by the force of gravity and as the pulley is rotated the circuit, including the condenser and primary coil of the transformer, is rapidly made and broken.

Fig. 17 shows a similar instrument in which, however, the make and break device is a jet of mercury impinging against an insulated toothed wheel carried on an insulated stud in the center of the cover of the pulley as shown. Connection to the condenser circuit is made by brushes bearing on this plug.

Fig. 18 is a photograph of another transformer with a mercury circuit controller of the wheel type, modified in some features on which it is unnecessary to dwell.

These are but a few of the oscillatory transformers I have perfected and constitute only a small part of my high frequency apparatus of which I hope to give a full description, when I shall have freed myself of pressing duties, at some future date.



its  
er  
to  
re  
ut  
e-  
he  
a  
ce.  
n-  
ts  
he  
nd  
he  
ry  
nd  
ch  
a  
y.  
he  
ng  
ry  
re  
n-  
or  
on  
n-  
e  
e-  
nt  
k-  
ar

pulley. This wheel is insulated and contact from it to the external circuit is established thru a mercury cup. As the pulley is rapidly rotated a jet of the fluid is thrown against the wheel, *thus making and break-*

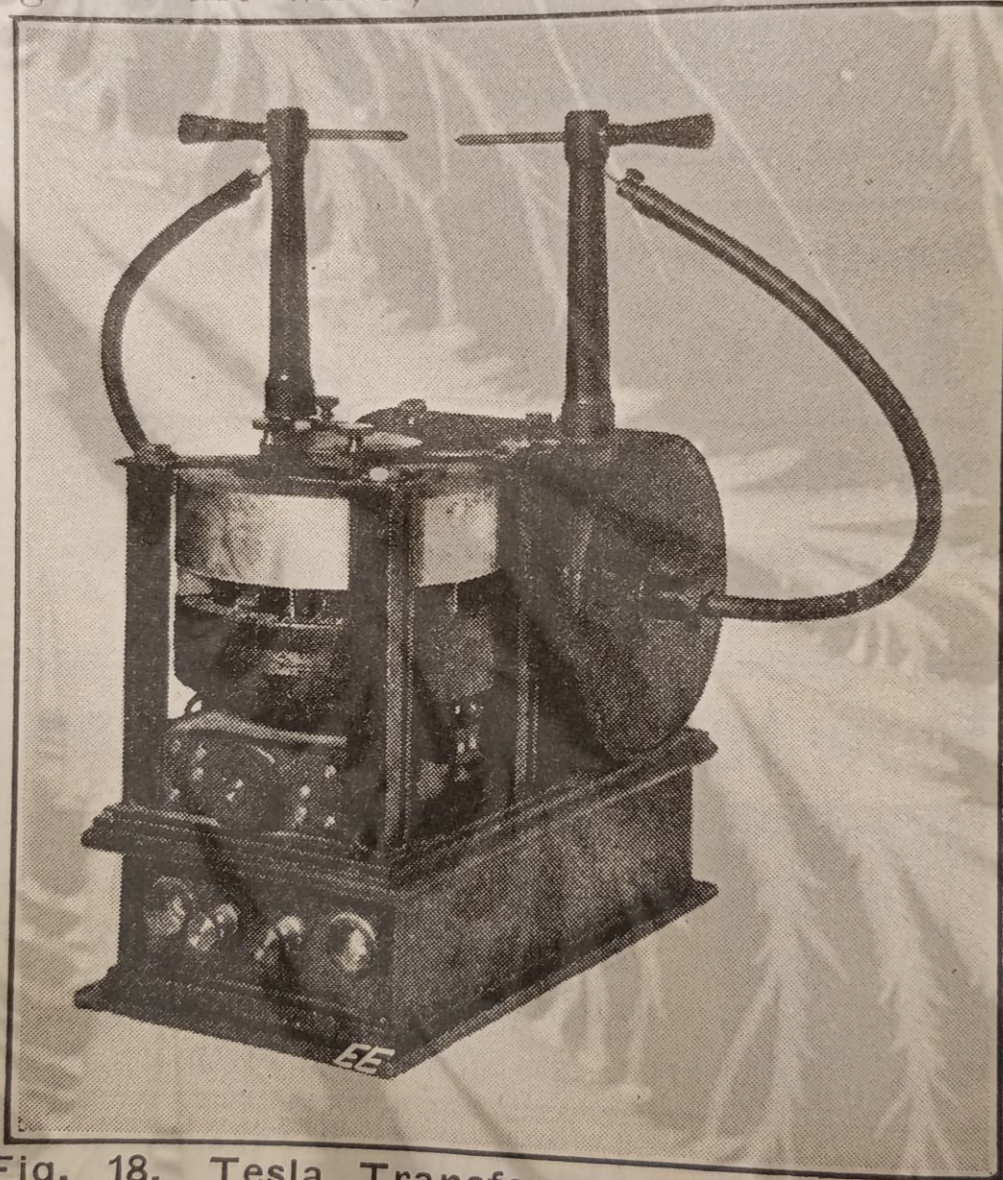


Fig. 18. Tesla Transformer With Mercury Jet Interrupter.

*ing contact about 1,000 times per second.*  
The instrument works silently and, owing to the absence of all deterioration



a 110 or 220 volt circuit, direct or alternating, preferably the former.

In Fig. 7 is shown a photograph of a

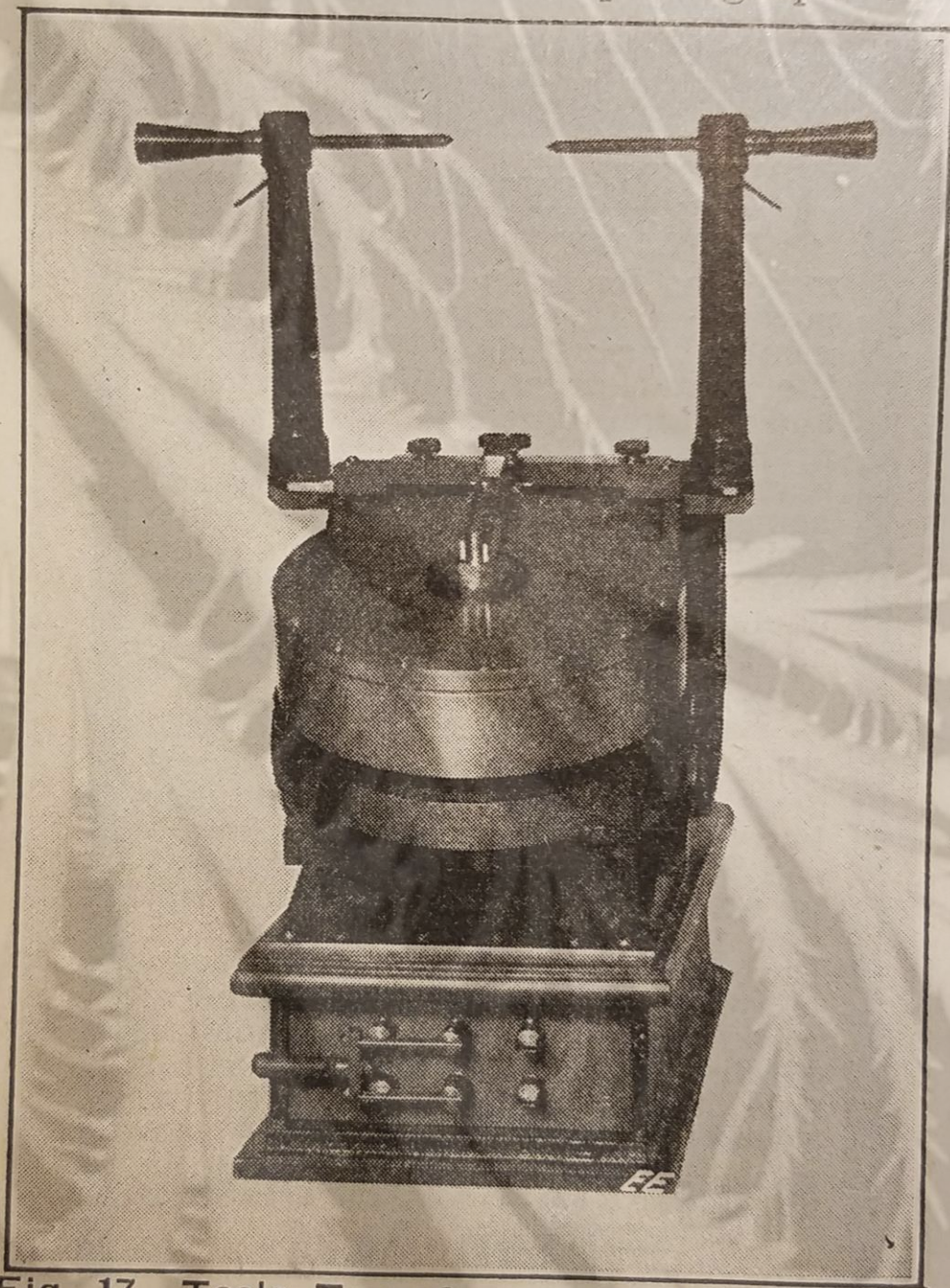


Fig. 17. Tesla Transformer With Adjustable Mercury Controller.

larger transformer of this kind. The construction and disposition of the parts is

ta  
of  
of  
1,0  
pr  
10  
ly  
bre  
slo  
Th  
str  
of  
con  
car  
bre  
bre  
ope  
esta  
rota  
The  
vess  
holl  
seal  
of  
trol  
of  
the  
dens  
oxyg  
teric  
trou  
ing  
Fi  
oscil



uments  
which,  
y years

ntended  
g light-  
ed and  
of any  
thin the  
elf-con-  
riods of  
ient and  
wireless  
sion of  
chemical  
combina-  
cture of  
al, hos-  
steriliza-  
tions in  
l institu-  
ve never  
principles  
th in my  
ore par-

mother  
Tesla,  
by us  
ue to  
sla, it  
sh his  
o the  
n this  
ortant  
n the

chief virtue of this kind of system is obviously due to the wonderful powers of the condenser, special qualities result from concatenation of circuits under observance of accurate harmonic relations, and minimization of frictional and other losses which has been one of the principal objects of the design.

(Continued on page 259)

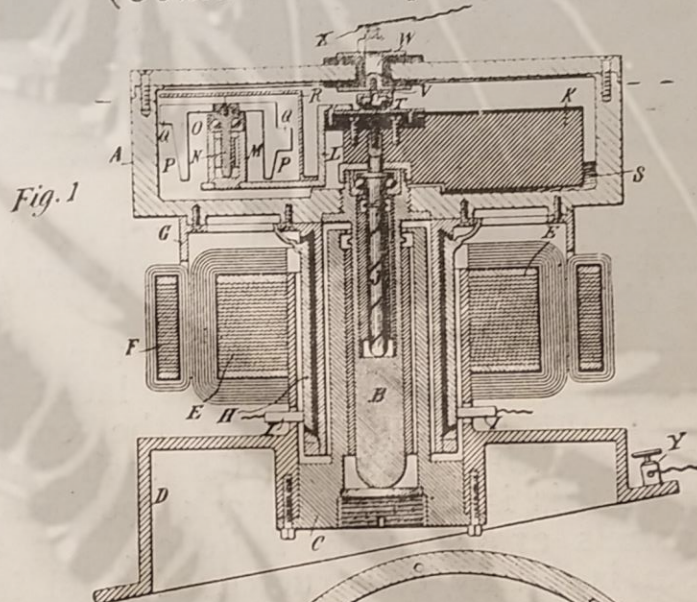


Fig. 2

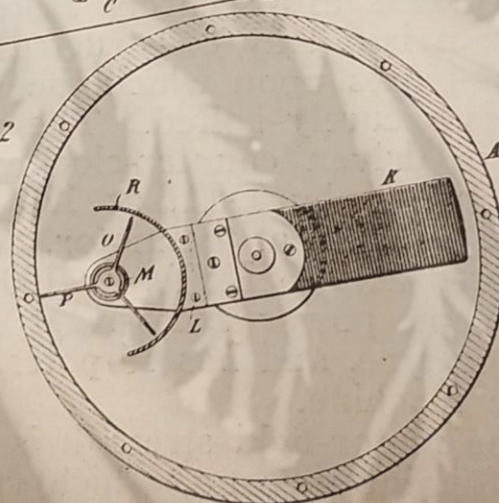
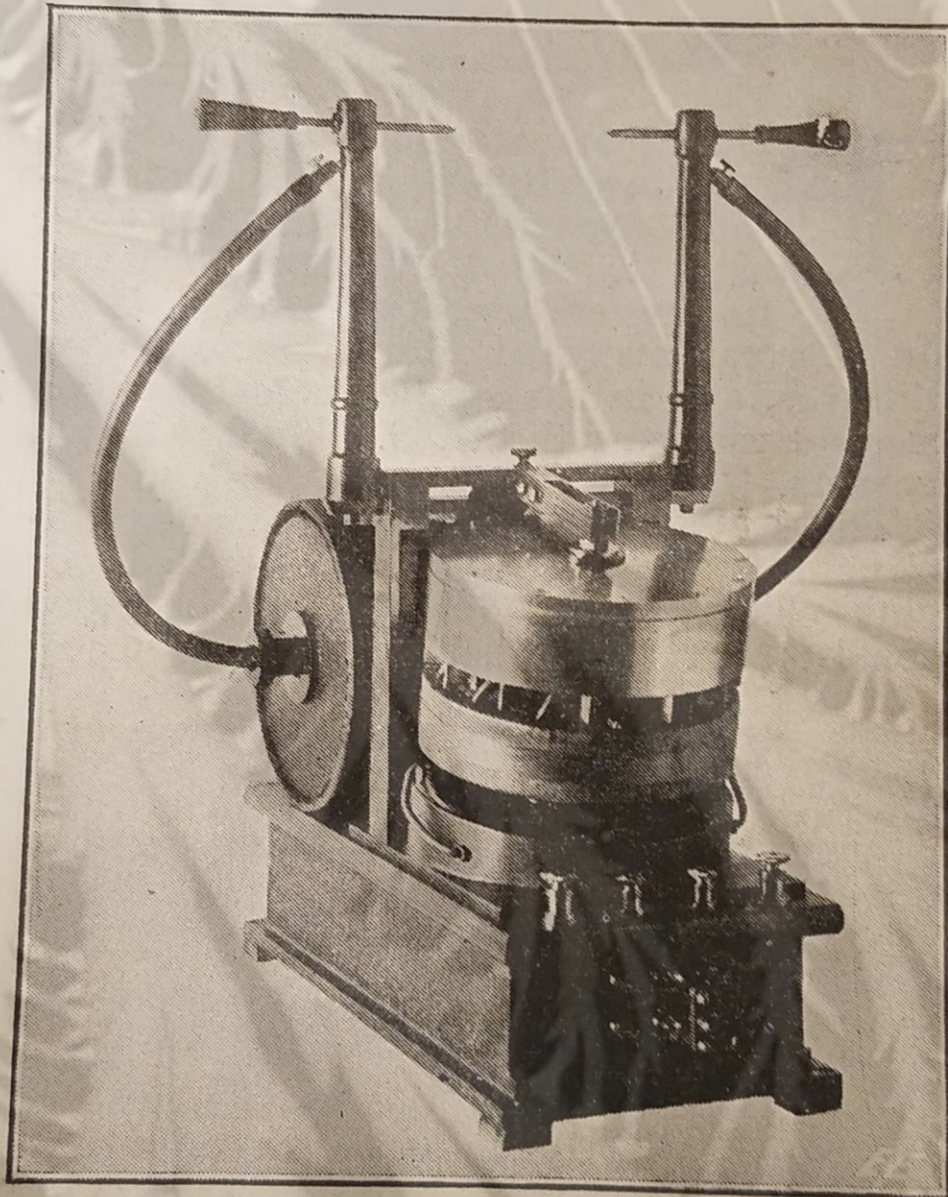


Fig. 16—Electrical Oscillator, Illustrated in Fig. 15, Showing Details of Motor and Break Mechanism.



a short explanation, will convey all the information that may be desired.

The essential parts of such an oscillator are: a condenser, a self-induction coil for



**Fig. 15—Tesla Transformer with Gravity Controlled, Sealed Mercury Interrupter.**

charging the same to a high potential, a circuit controller, and a transformer which is energized by the oscillatory discharges of the condenser. There are at least



eight years ago. I developed not less than fifty types of these transformers or electrical oscillators, each complete in every detail and refined to such a degree that I could not materially improve any one of them today. Had I been guided by practical considerations I might have built up an im-

ago!

These oscillators were designed to operate on circuits of undamped oscillations, of frequency, within the widest limits, maintained, requiring little time and will be useful for telegraphy and electrical engineering compounds; synthesis of ozone; light production, and domestic use, and in scientific laboratories. While they have been described in the underlying technical publications.

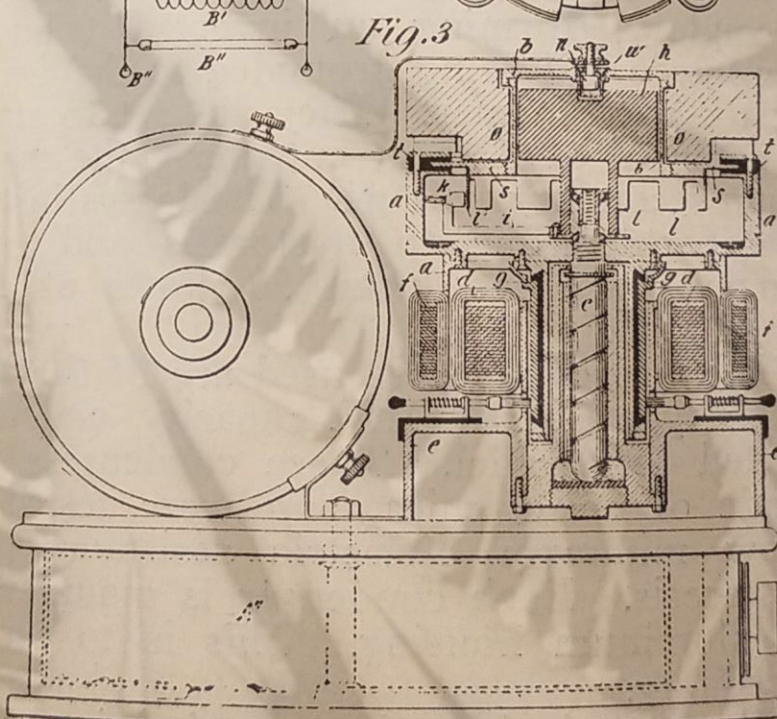
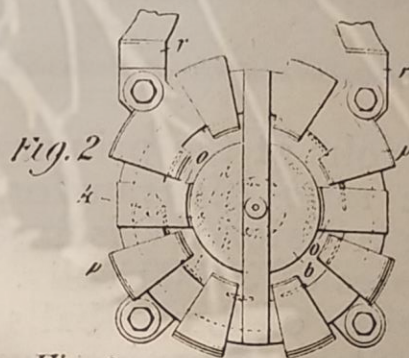
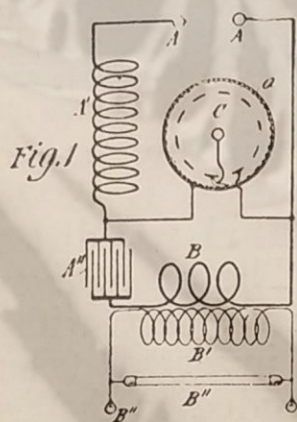
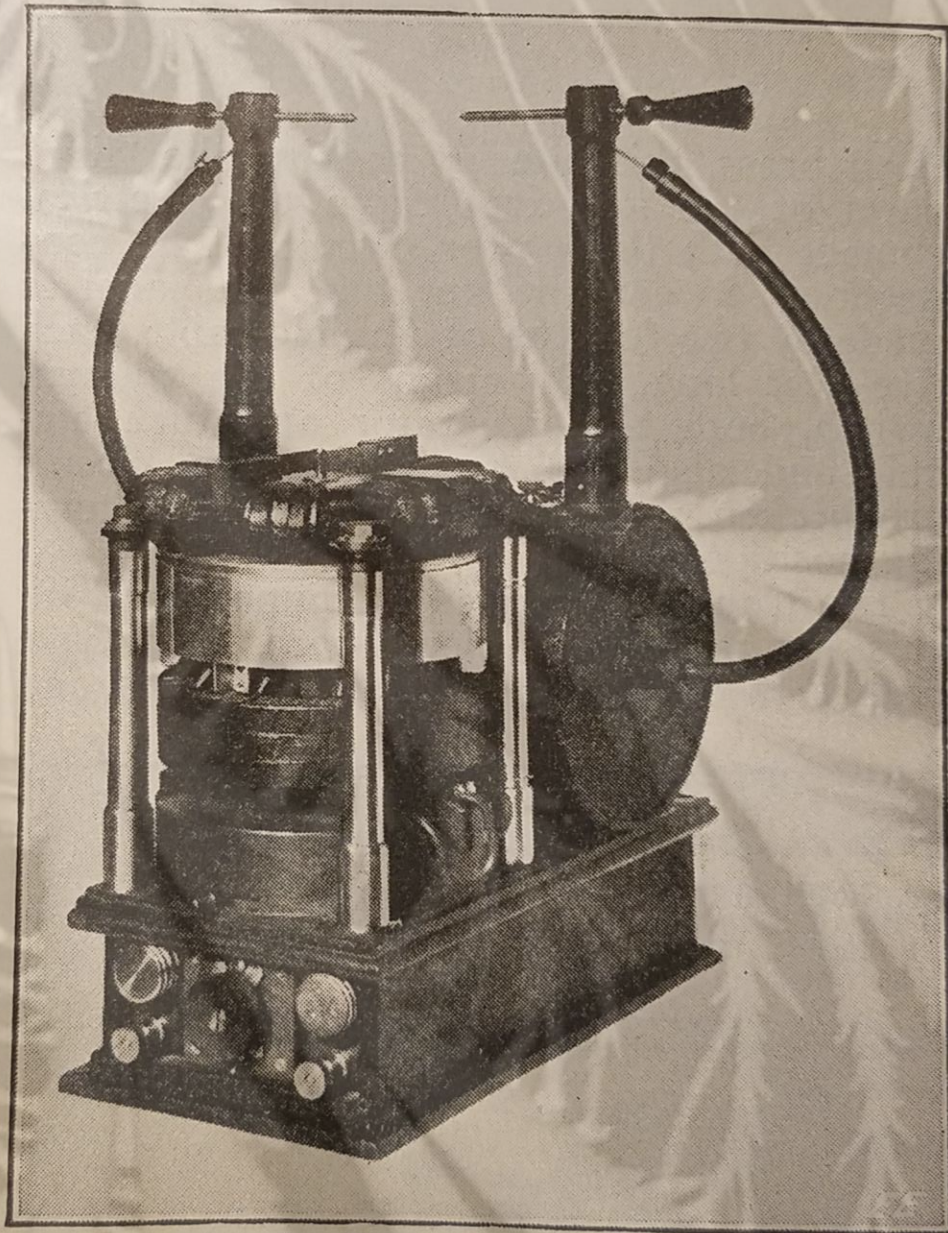


Fig. 14—Electrical Oscillator, Illustrated in Fig. 13, Showing Details and Circuit Connections.

Last month a special feature which attracted much attention was not very important. It was important for historical special feature page taken from historical August 1



currents. Their singular properties and the spectacular character of the phenomena they presented immediately commanded universal attention. Scientific



**Fig. 13—Tesla Oscillator with Magnetically Controlled, Sealed Mercury Interrupter.**

men became interested in their investigation, engineers were attracted by their commercial possibilities and chemi-



Fig. 12.  
Another  
type of  
Tesla  
Trans-  
former with  
sealed mer-  
cury inter-  
rupter





metically  
sealed mer-  
cury inter-  
rupter

sealed mer-  
cury inter-  
rupter

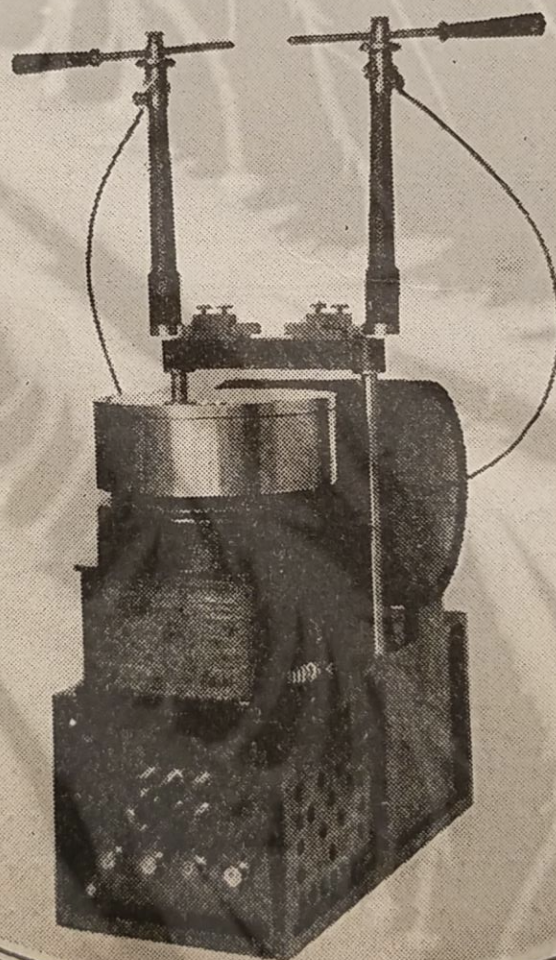


Fig. 11. Tesla Transformer  
with sealed mercury interrupter  
for low tension work



former  
with her-  
metically  
sealed mer-  
cury inter-  
rupter

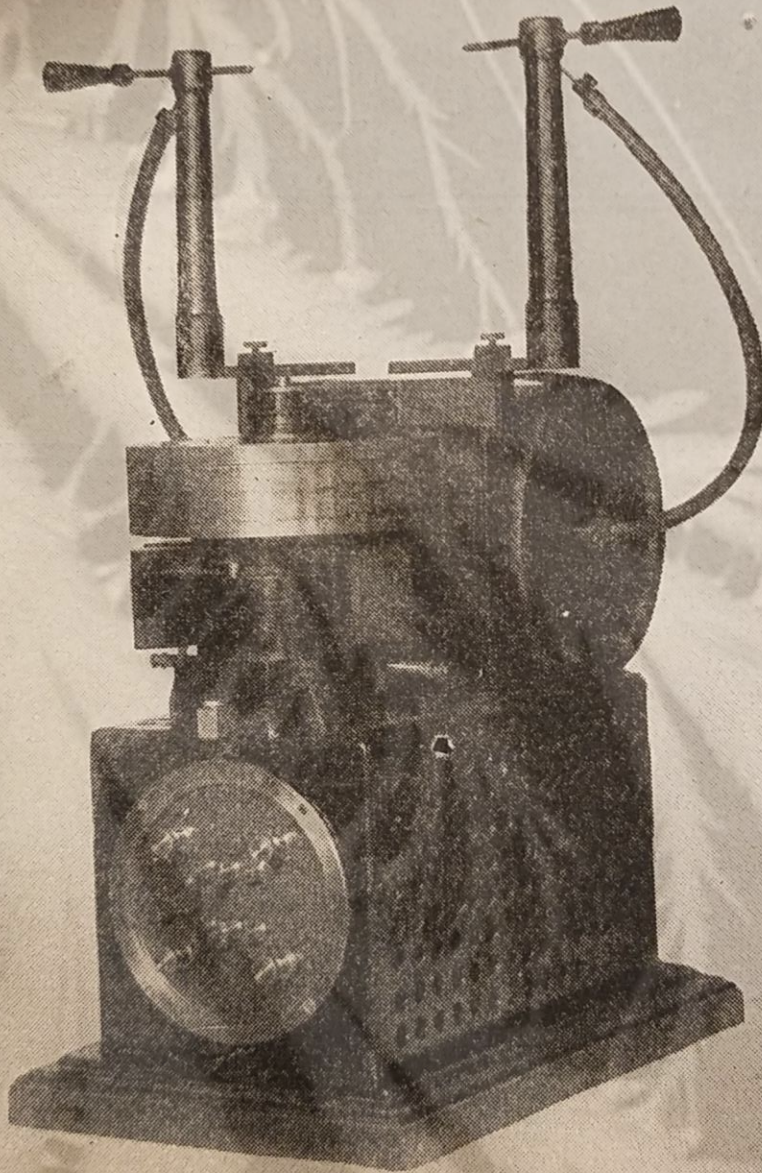
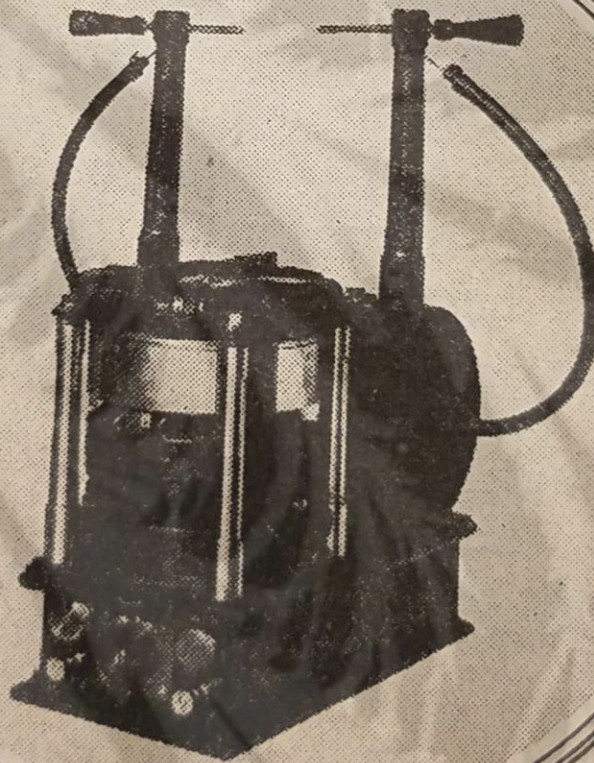
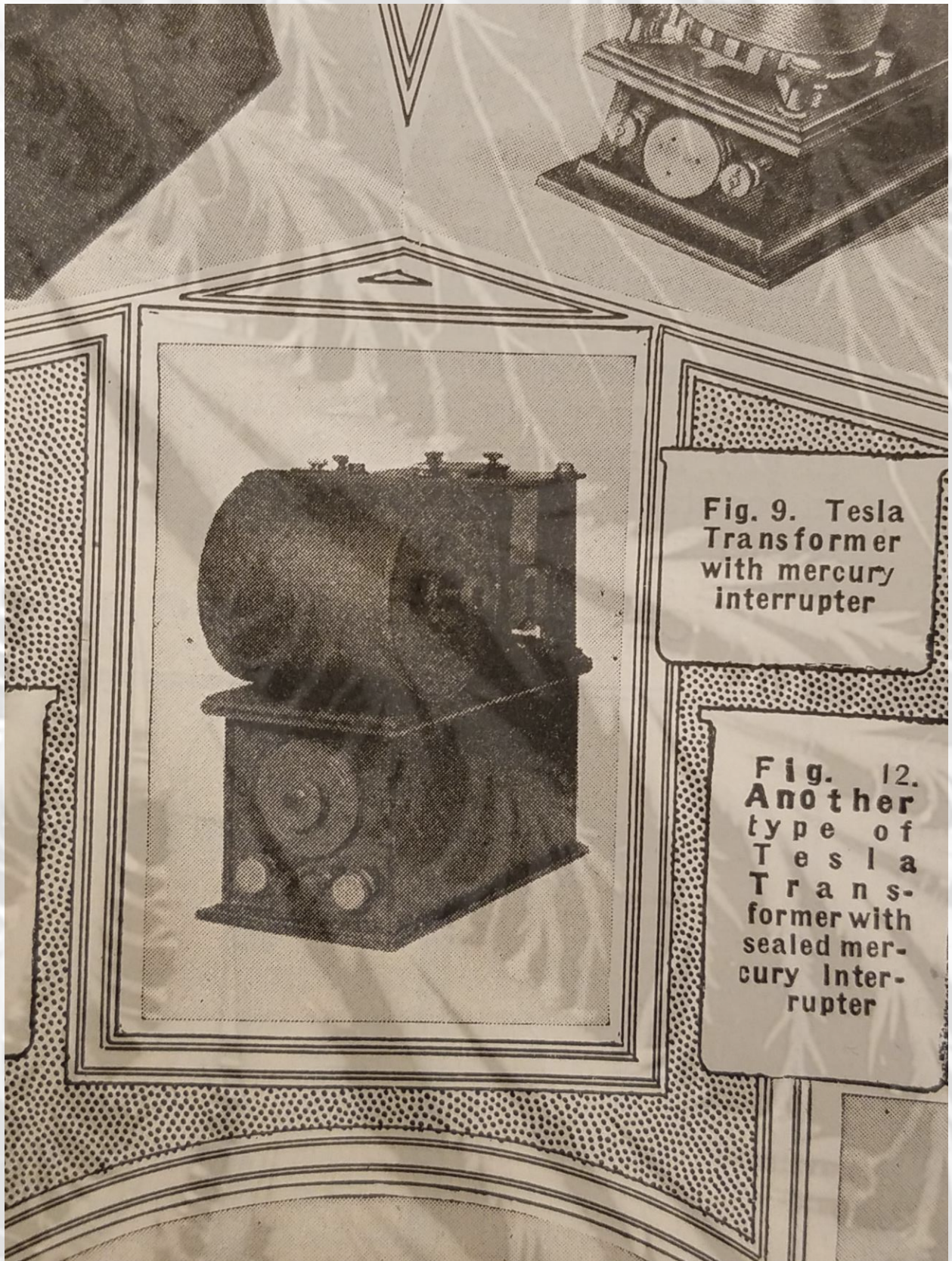




Fig. 8. Tesla Transformer  
with rotary break for  
wireless







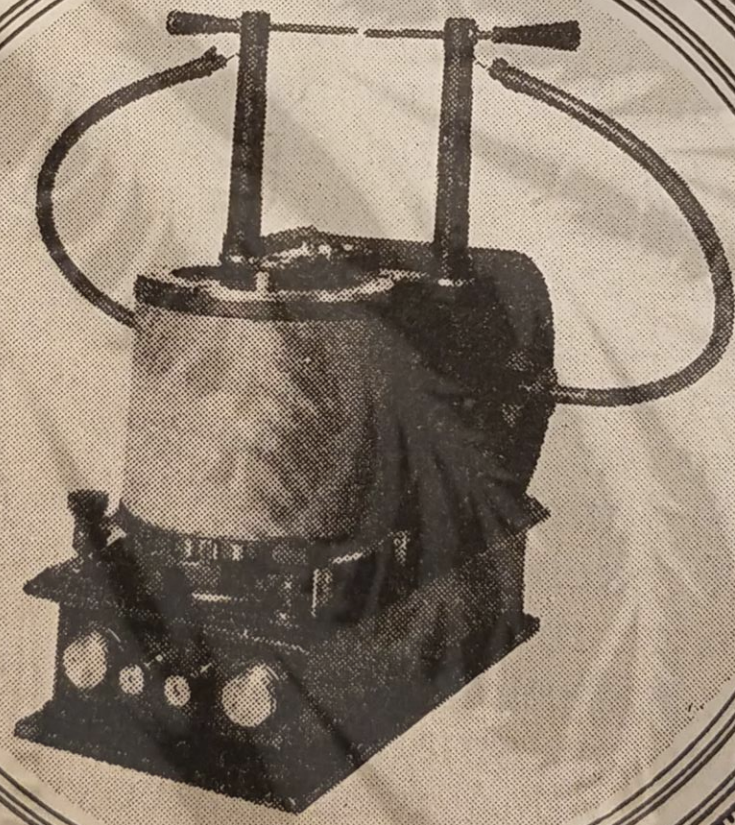
**Fig. 9. Tesla  
Transformer  
with mercury  
interrupter**

**Fig. 12.  
Another  
type of  
Tesla  
Trans-  
former with  
sealed mer-  
cury inter-  
rupter**



former  
for experi-  
mental  
purposes

Fig. 7. Large Tesla  
Transformer for various  
purposes



T  
f  
v  
n  
s  
c



Fig. 5.  
Later type  
of Tesla  
Trans-  
former





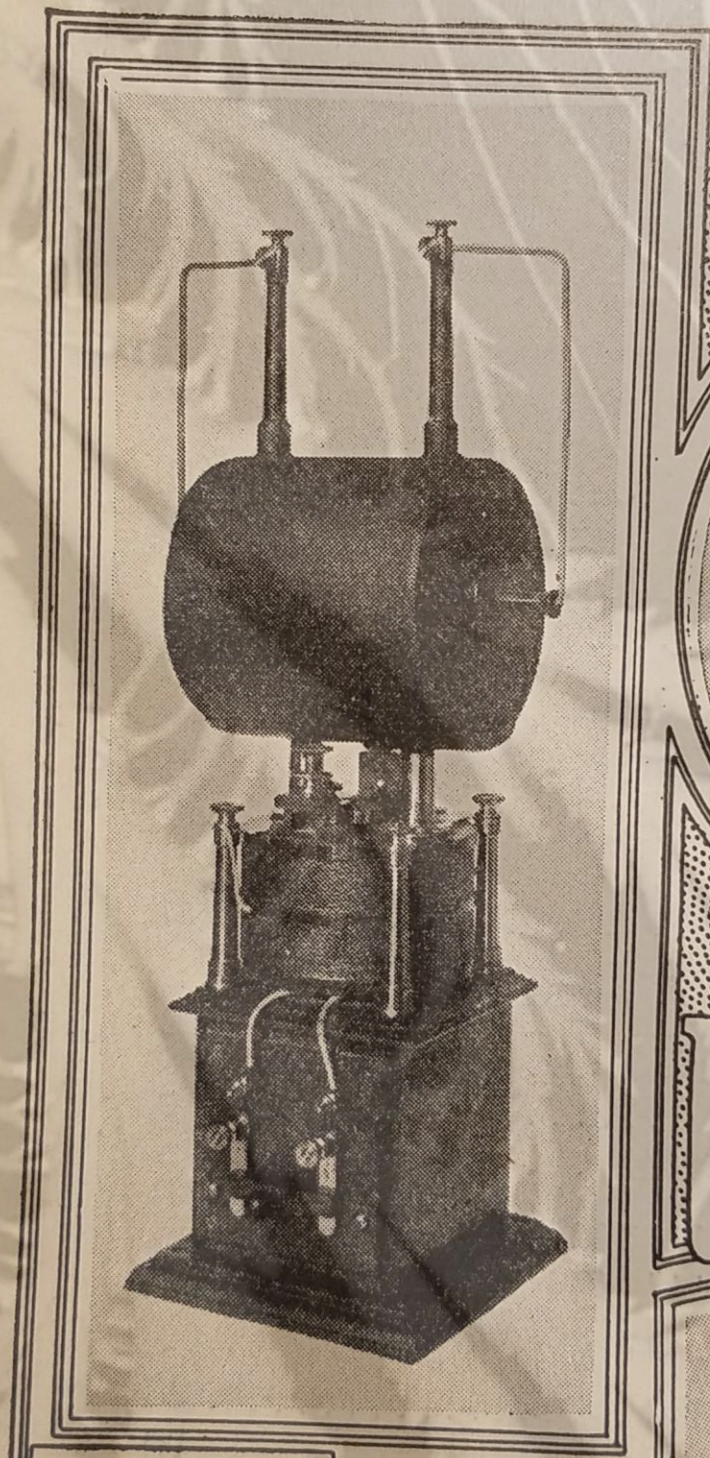


Fig. 1. Os-  
cillator  
with de-

Fig. 2. Small  
gas engine ign  
u



Fig. 5.  
Later type  
of Tesla  
Trans-  
former





Fig. 2. Small Tesla Coil for  
gas engine ignition and similar  
uses

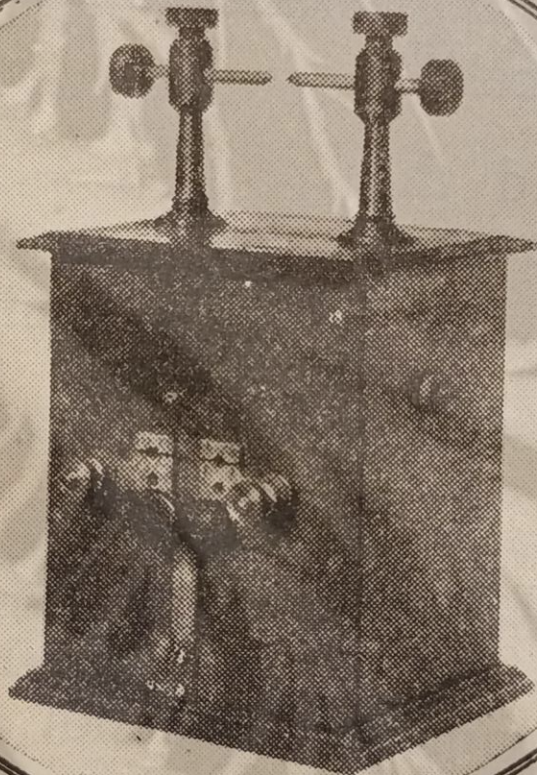


Fig. 5.  
Later type  
of Tesla  
Trans-  
former

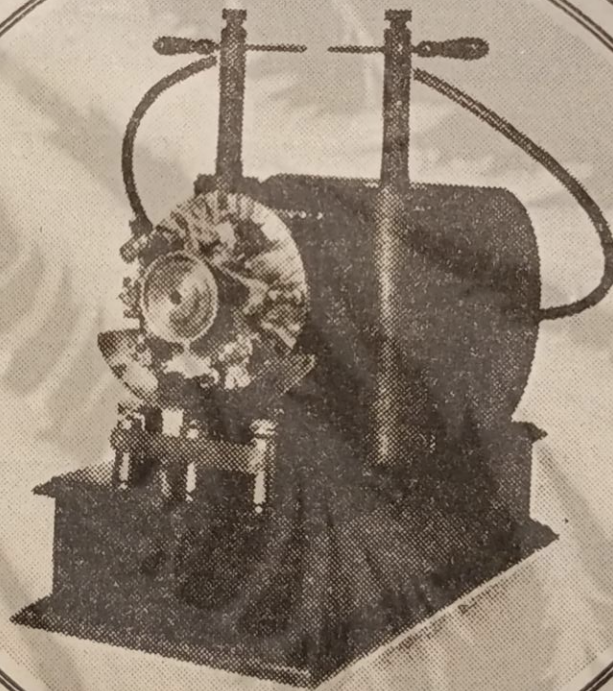




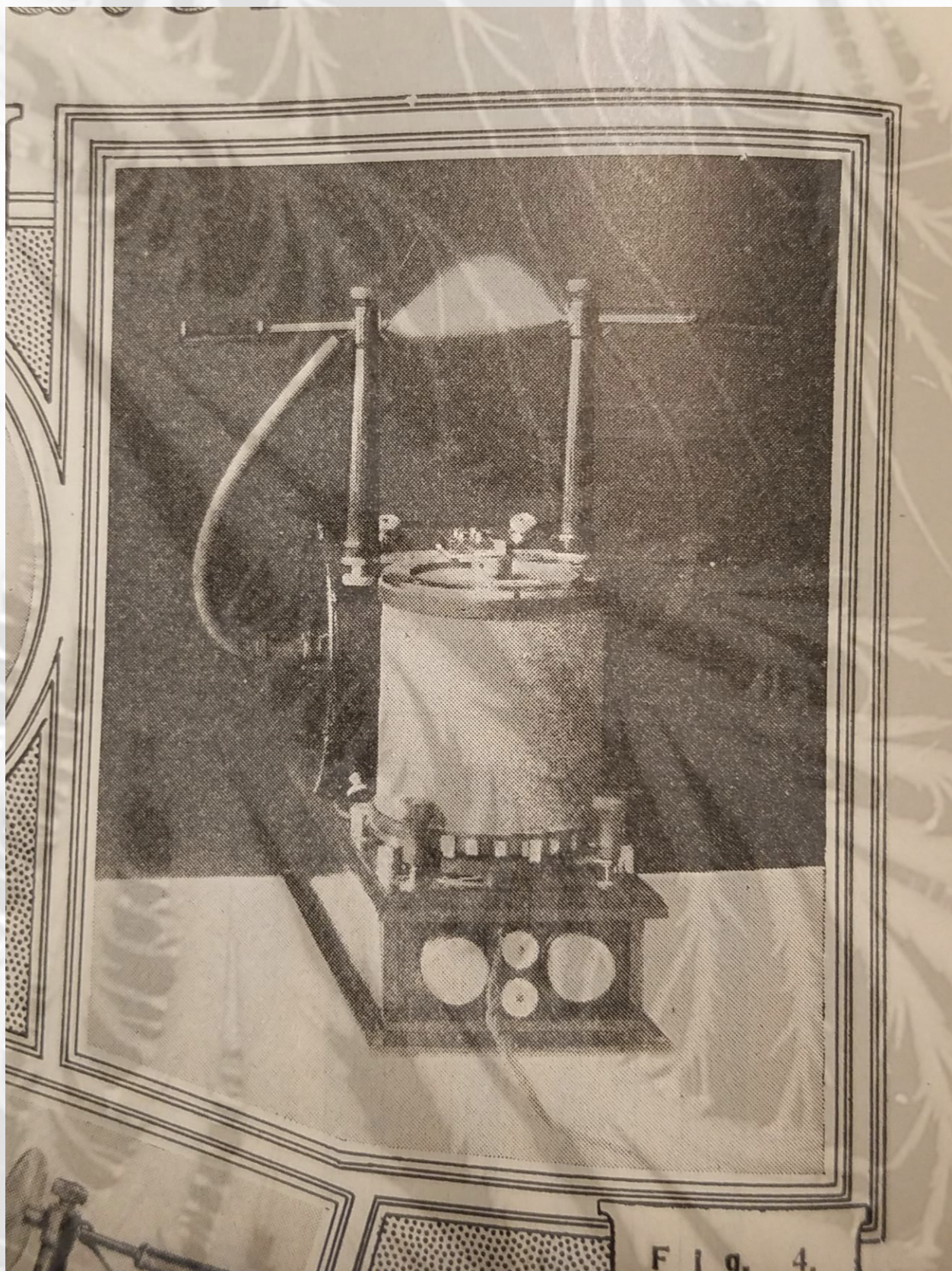
# cal Oscillat

or  
ar

Fig. 3. Tesla Transformer, 12  
Inch spark, chiefly for wireless









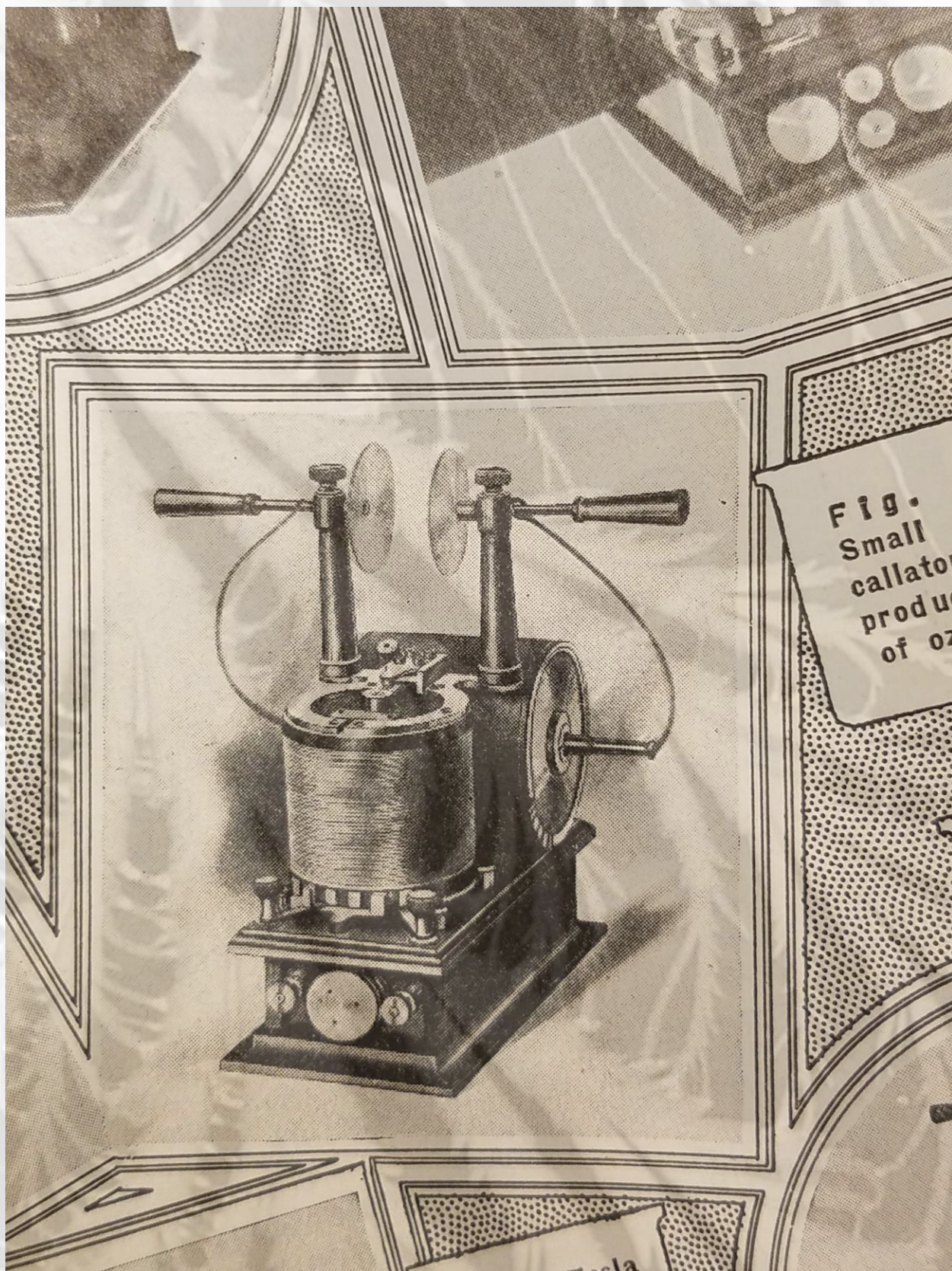


Fig.  
Small  
callator  
product  
of oz

tesla



# Regain Your Health Thru Renulife VIOLET RAY Treatments at Home



Unequaled for  
neuritis and rheu-  
matism

More Than 25,000 Vols.  
No pain, shock or mus-  
cular contraction. Entire-  
ly harmless—powerfully  
effective.

There is no "quackery" or uncertainty about *Renulife Violet Ray*. It is not claimed to be a "Cure All," but it has proved in thousands of cases a practical health-producing, revitalizing agent—powerful in restoring normal physical conditions—yet gentle, soothing and perfectly safe. You can treat yourself. Get full information regarding uses shown on coupon below.

## Users Get Wonderful Results

### (Voluntary Testimonials)

"The *Renulife Violet Ray* High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of *Electrode* holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I wish I had got it a year ago. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a *Renulife Violet Ray* High Frequency Generator, for the treatment of Neuralgia, Neuritis, Sore Throat, kernels in Neck, Cramps, Headache, Stiff Neck, Muscular Soreness, Rheumatism, Paralysis—in short, pains of all kinds." "M. D. I have been much relieved by the use of your *Violet Ray* Generator." "It is fine for Insomnia." "I find it such a help in nervousness." "I would not part with it for five times the price. It is sure a little wonder." "I am more than pleased with the Generator; the whole family are using it." "A neighbor lady was suffering from lumbago and could not move, and my wife brought over the Generator and in less than ten minutes the lady was greatly relieved." "Your Generator is just the thing for me. That tired feeling has left me, and I feel like myself again." "It has relieved me of the nervousness and also it has helped me a great deal in using it for the treatment of rheumatism."

This type *Violet Ray* Instrument is designed with light handle, easily manipulated; the most of the apparatus is contained in a case giving ample space for electric units of efficient size.

## How *Renulife* Benefits

Science has demonstrated a strange relation between electricity and life cells. This instrument harnesses a tremendous current of electricity and applies in the form of *Violet Rays* so that the body welcomes and responds to it in a marvelous manner—no pain—shock or the slightest harmful effects. A few seconds of *Renulife Violet Ray* gives more benefit than hours of the old time battery methods—because a thousand times as much voltage is made use of.

The irresistible, revitalizing powers of *Renulife Violet Ray* reach every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions retarded to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep seated cause, combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

## Get Book "Health via Violet Ray"

Learn the whole marvelous story of the *Violet Ray*—this method that works with nature to restore and build up. Learn how you, at home, can now use these great curative forces of *Violet Ray*—heretofore only available at big expense from physicians or beauty doctors. Send coupon or postal card now and receive free book describing uses, quoting low prices (within the reach of all) and explaining liberal Trial Plan.

**Renulife Electric Co., Inc.**  
1210 Marquette Bldg., Detroit, Mich.  
CANADIAN: RENULIFE ELECTRIC CO., Ltd.,  
1210 Netline Bldg., Windsor, Ont.  
Toronto Office: 612 C. P. B. Building.  
(Live Sales Representatives write for proposition)



Increases energy and  
vitality



Treatment for nervous-  
ness and general  
debility



Ozone most beneficial  
for catarrh, throat and  
lungs. Also scurvy



Stops falling hair —  
promotes hair growth.  
Wonderful beauty aid

Chicago Office  
Room 410  
123 West Madison

Copyright, 1919, R. E. Co.

## BOOK FREE



Lowest  
Prices  
Efficient  
VIOLET  
RAYS

3  
Models  
for  
Home  
Use

## COUPON FOR BOOK and Special Information

**RENULIFE ELECTRIC CO.,**  
1210 Marquette Bldg., Detroit, Mich.  
Please send without obligation, your book "Health," explaining *Violet Ray* treatments with *Renulife* Generators; also give full particulars as to its application for ailments checked below.

**TREATS SUCCESSFULLY**

• Abscesses	• Facial Neuralgia	• Piles
• Anemia	• Falling Hair	• Pimples
• Asthma	• Gout	• Protrusion
• Arteriosclerosis	• Hay Fever	• Rheumatism
• Baldness	• Infantile Paralysis	• Scars
• Blackheads	• Insomnia	• Scurvy
• Brain Fog	• Lumbago	• Skin Diseases
• Catarrh	• Locomotor Ataxia	• Sprains
• Colds	• Nervous Affections	• Toothache
• Chills	• Neuritis	• Weak Eyes
• Chills	• Paralysis	• Wrinkles
• Dandruff	• Enlarged Prostate	• Warts and Moles
• Deafness		
• Eczema		

Write your name and address in margin below and cut out with coupon

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.



Now made  
simple and  
perfectly safe



# TREAT YOURSELF With The Wonderful Health Restorer VIOLET RAY

You Can Have Bodily Vigor, Success—Attaining Energy, Attractive, Healthful Beauty

All at practically no cost—The great benefits of the Violet Ray treatments heretofore only procurable at big expense from physicians and beauty specialists are now available in your own home. Look over list of treatments below. Send for particulars.

## How Violet Ray Benefits

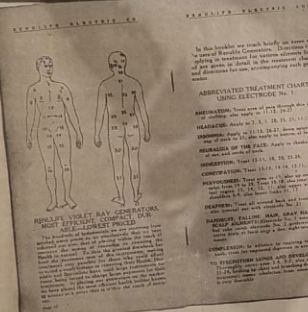
Electricity from your light socket is transformed into health and beauty-giving Violet Ray—powerfully effective, yet gentle, soothing, perfectly safe. Voltage is raised from ordinary lighting current to thousands of volts, giving tremendous penetrative force.

The irresistible, revitalizing powers of *Renulife Violet Ray* are carried at once to every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions restored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep-seated cause; combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

## Painless Electricity

Science has modified electricity that the weakest may stand its force without fear or pain. Every tissue and fibre is saturated, patient experiencing only a sensation of relief, as if standing in a ray of sunshine. *Violet Ray* high frequency has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvellously rapid. Relief can be given in one or more treatments. Often cures are accomplished in that time. It is positive and certain in action. If you value your health, and want to keep or restore your good looks and gain vitality, throw away medicine bottles—take this sensible, scientific means. *Violet Rays* work with nature. Every day's delay makes relief more difficult.

## Renulife Violet Ray HIGH FREQUENCY GENERATORS



## COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,  
1207 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with *Renulife* Generators; also give full particulars as to its application for ailments checked below

## TREATS SUCCESSFULLY

- |                             |                       |                                   |
|-----------------------------|-----------------------|-----------------------------------|
| ..Anemia                    | ..Facial Neuralgia    | ..Obesity                         |
| ..Asthma                    | ..Falling Hair        | ..Pain in Abdomen                 |
| ..Arteriosclerosis          | ..Female Complaints   | ..Paralysis                       |
| ..Baldness                  | ..Gout                | ..Piles                           |
| ..Blackheads                | ..Haemorrhoids        | ..Pyorrhea                        |
| ..Brain Fag                 | ..Hay Fever           | ..Rheumatism                      |
| ..Bronchitis                | ..Infantile Paralysis | ..Scars                           |
| ..Bunions                   | ..Insomnia            | ..Skin Diseases                   |
| ..Bruises                   | ..Lameness            | ..Sore Throat and Throat Diseases |
| ..Catarrh                   | ..Lumbago             | ..Sprains                         |
| ..Colds                     | ..Lumbar Aches        | ..Toothache                       |
| ..Chilblains                | ..Nervous Affections  | ..Weak Eyes                       |
| ..Dandruff                  | ..Neuritis            | ..Wrinkles                        |
| ..Deafness and Ear Diseases |                       |                                   |
| ..Eczema                    |                       |                                   |
| ..Enlarged Prostate         |                       |                                   |

Name .....

Address .....

## Offered on a Most Liberal TRIAL PLAN Learn the Wonderful Benefits by Actual Use

RENULIFE ELECTRIC CO., 1207 Marquette Bldg., Detroit, Mich.

CANADIAN RENULIFE ELECTRIC CO.  
1207 Netting Bldg., Windsor, Ont.

## SALES REPRESENTATIVES WANTED



Unequaled for scalp and hair



Brings beauty parlour to your home



Inhaling ozone. For Catarrh, throat and lungs. Marvellous local results with general tonic effect



Treatment for general debility, nervousness, etc.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.



APRIL,  
1919  
20 CTS.

# ELECTRICAL EXPERIMENTER

## SCIENCE AND INVENTION

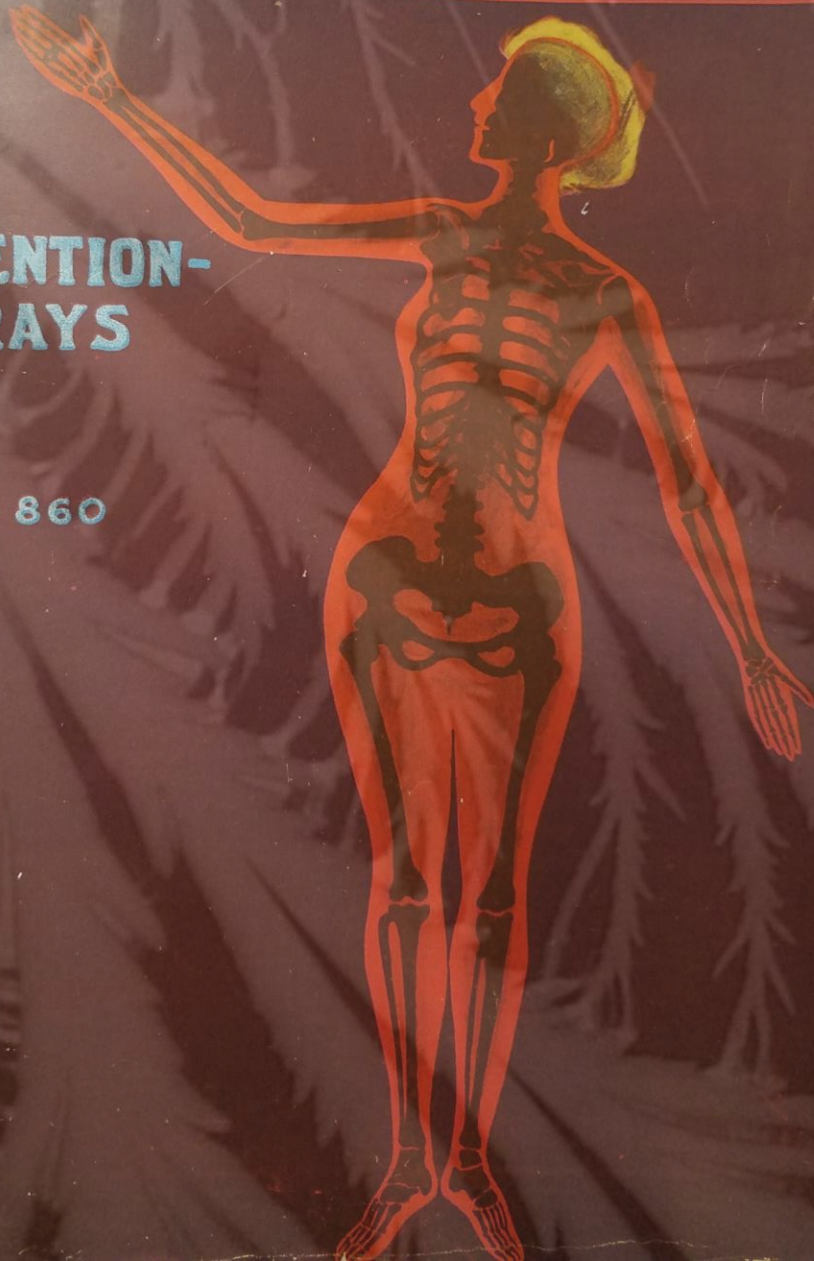
OVER  
175  
ILLUST.

REG. U.S. PAT. OFF.

A NEW INVENTION-  
NOT X-RAYS

?

SEE PAGE 860





NOVEMBER  
1919  
20 Cts.

# ELF TAL EXPERIMENTAL SCIENCE TITION

Over  
175  
Illustr.

REG. U.S. PAT. OFF.

**COLD  
"FIRE"**  
?  
SEE PAGE 632





MARCH  
1920  
25 cts.

# ELECTRICAL EXPERIMENTER

## SCIENCE AND INVENTION

OVER  
200  
ILLUST.

POWER  
TRANSMITTED  
BY WIRELESS  
SEE PAGE 1118



HOWARD BROWN  
OVER 150,000 COPIES MONTHLY—LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



John Odell  
*John Odell*

# The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED

THE TESLA DESTROYER

SEE PAGE 614

*opportunities  
Pennsylvania*



MARCH  
1916  
10 CTS

LARGEST CIRCULATION OF ANY ELECTRICAL MAGAZINE



JUNE, 1916

10 CENTS

# The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



NOVEMBER, 1916

15 CENTS

# The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED



LIGHTNING  
MADE TO ORDER  
SEE PAGE 474

LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



FEBRUARY, 1917

PHOTO SUPPLEMENT NUMBER

15 CENTS

M. MICKELSON

# The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED

## TRENCH DESTROYER

SEE PAGE 714

M. MICKELSON



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



AUGUST, 1917

ENTS

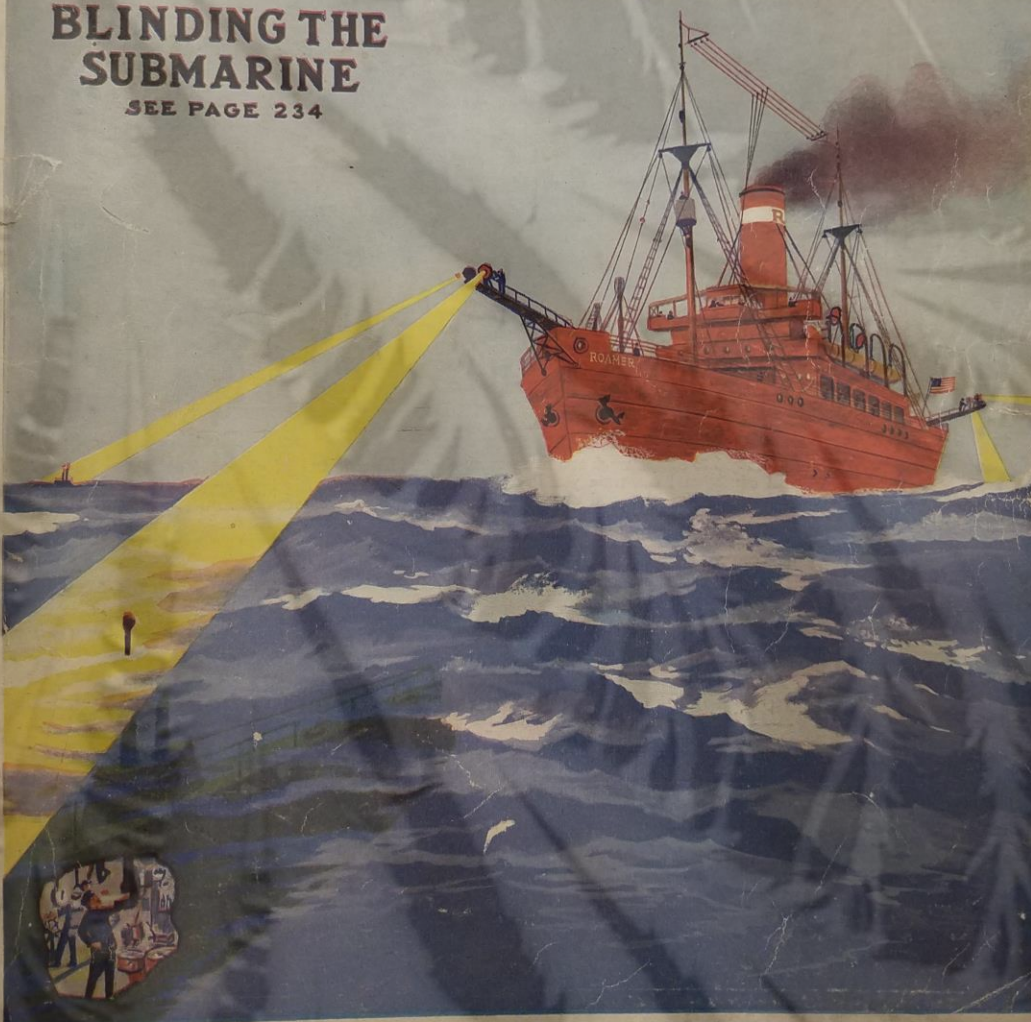
# The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED

Vol. 5 #4

**BLINDING THE  
SUBMARINE**

SEE PAGE 234



☆

LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



SEPTEMBER, 1917

*A. R. Marcy*

15 CENTS

# The Electrical Experimenter

POPULAR ELECTRICAL NEWS ILLUSTRATED

ELECTRIC "BLOODHOUNDS"  
FIND AND DESTROY SUBMARINES

SEE PAGE 298

Vol. 5

# 5



☆

LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



OCT.  
1918.  
15 CTS.

# ELECTRICAL EXPERIMENTER

## SCIENCE AND INVENTION

OVER  
175  
ILLUST.

REG. U.S. PAT. OFF.

THE AUTOMATIC  
SOLDIER  
SEE PAGE 372



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION



JAN.  
1919  
20 CTS.

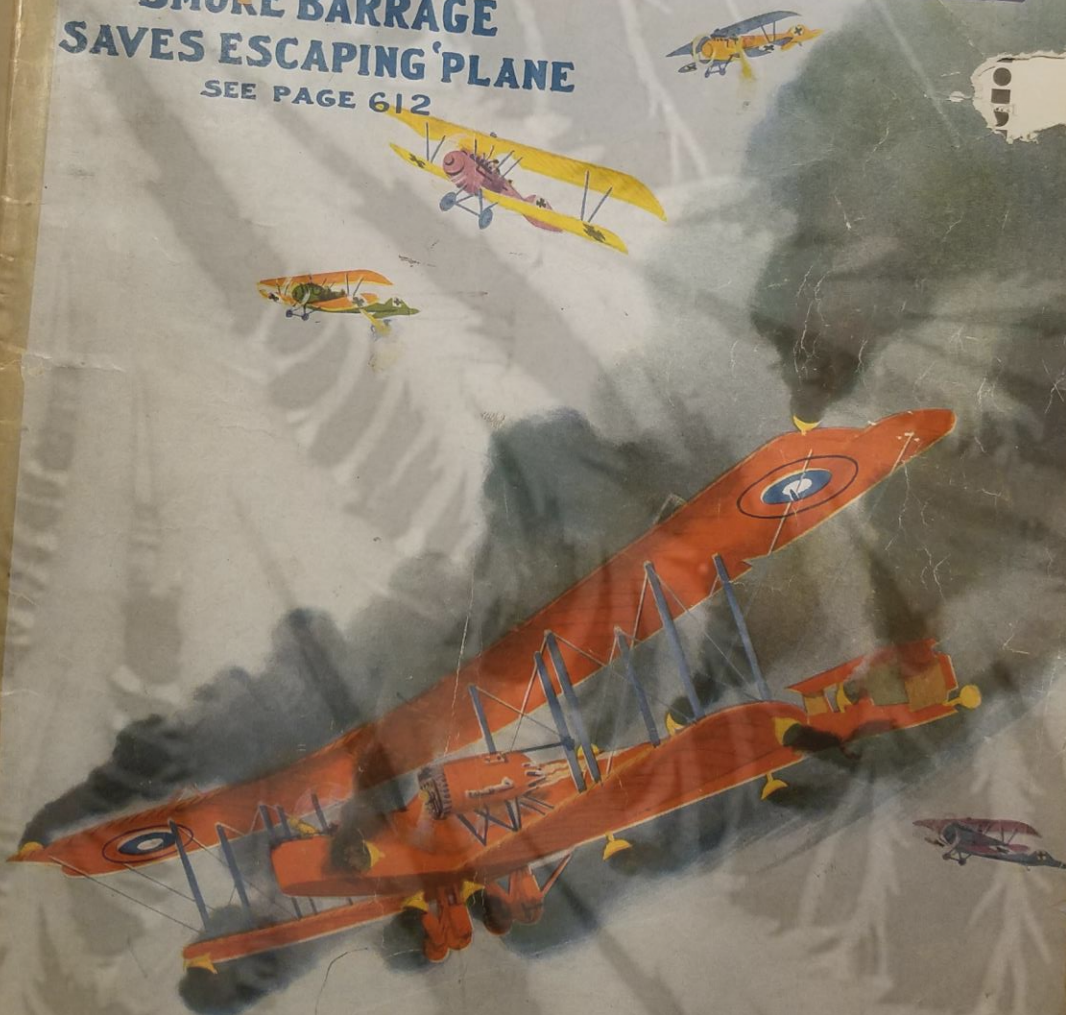
# ELECTRICAL EXPERIMENTER

## SCIENCE AND INVENTION

OVER  
175  
ILLUST.

REG. U.S. PAT. OFF.

**SMOKE BARRAGE  
SAVES ESCAPING PLANE**  
SEE PAGE 612



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

American Technical Publications - Journals - Electrical Experimenter - August, 1919 / March, 1919



Beginning: My Inventions, by Nikola Tesla

FEB.  
1919  
20 CTS.

# ELECTRICAL EXPERIMENTER

## SCIENCE AND INVENTION

OVER  
175  
ILLUST.

REG. U.S. PAT. OFF.

**THE TESLA  
WIRELESS LIGHT**  
SEE PAGE 692

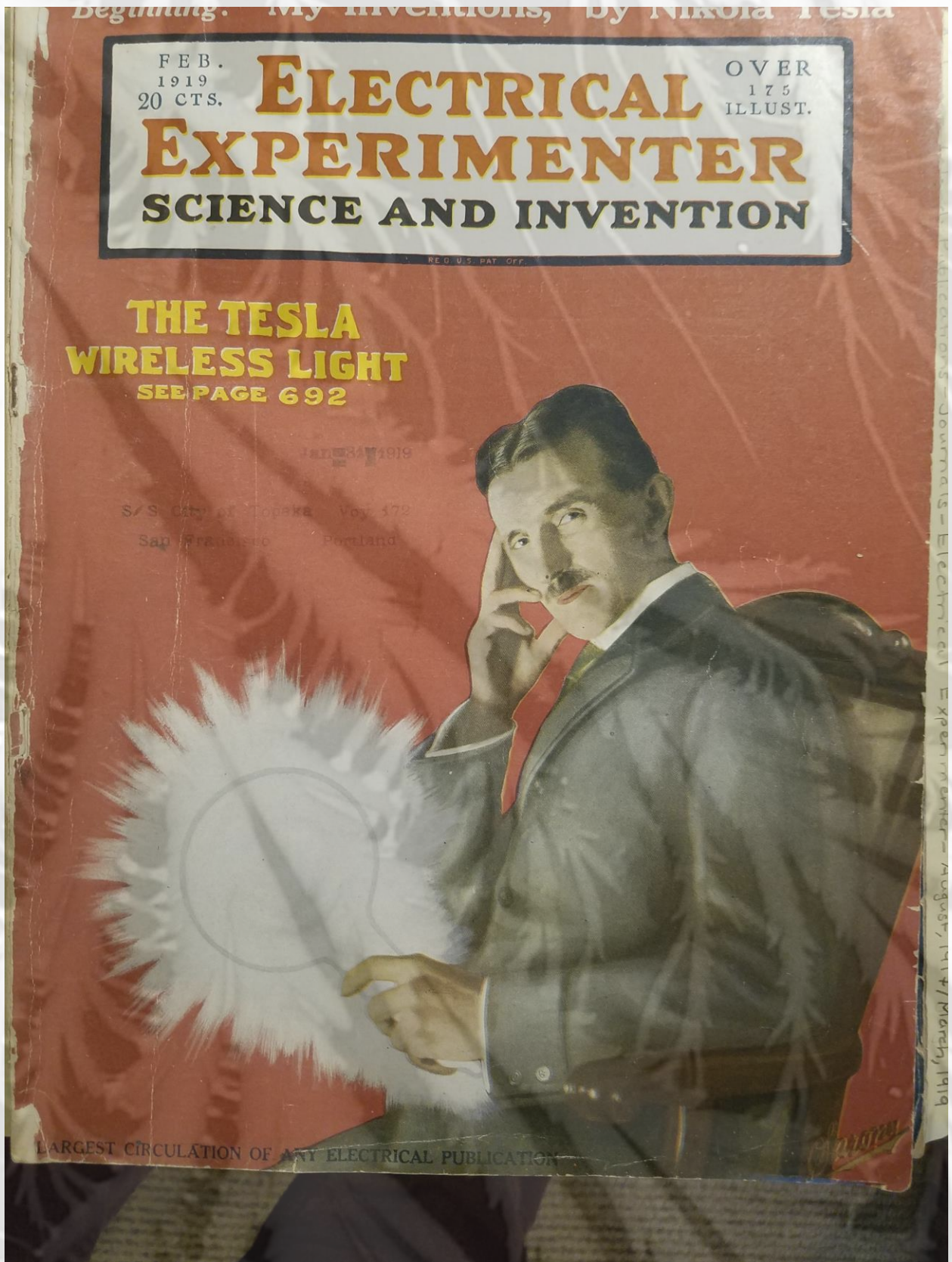
January 1919

S/S City of Topeka Vol. 172

San Francisco Portland

LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

Publications - Journals - Electrical Experimenter - August, 1917 / March, 1919





MARCH,  
1919  
20 CTS.

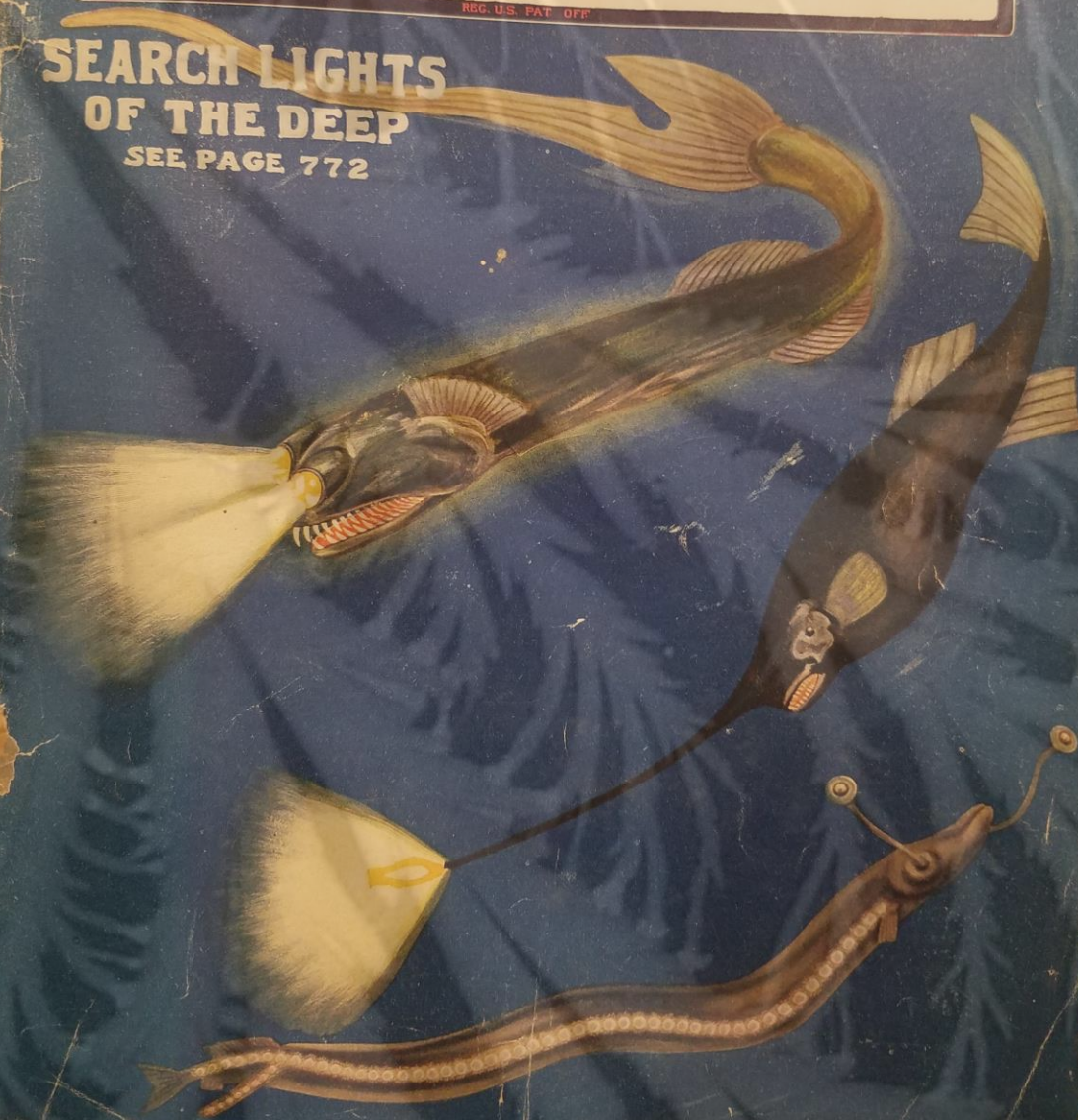
# ELECTRICAL EXPERIMENTER

## SCIENCE AND INVENTION

OVER  
175  
ILLUST.

REG. U.S. PAT. OFF.

SEARCH LIGHTS  
OF THE DEEP  
SEE PAGE 772



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

Anderson, H. and - Publications - Journals - Electrical Experimenter - August, 1917 / March, 1919